Filed: April 12, 2022

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.

Petitioner,

v.

MASIMO CORPORATION,

Patent Owner.

Case IPR2020-01538
U.S. Patent 10,588,554

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgement – Final Written Decision (Paper No. 43) entered on February 23, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered March 2, 2021 (Paper 8). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1–7 and 20–28 of U.S. Patent 10,588,554 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2020-01538 involving U.S. Patent 10,588,554.

Masimo is concurrently providing true and correct copies of this Notice of Appeal, along with the required fees, with the Director of the United States Patent and Trademark Office and the Clerk of the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: April 12, 2022

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ATTACHMENT A

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571-272-7822

Paper 43
Entered: February 23, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,

Petitioner,

v.

MASIMO CORPORATION,

Patent Owner.

IPR2020-01538
Patent 10,588,554 B2

Before GEORGE R. HOSKINS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges.*

WIEKER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–7 and 20–28 ("challenged claims") of U.S. Patent No. 10,588,554 B2 (Ex. 1001, "the '554 patent"). Paper 3 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a Preliminary Response. Paper 7. We instituted an *inter partes* review of all challenged claims 1–7 and 20–28 on the sole asserted ground of unpatentability, pursuant to 35 U.S.C. § 314. Paper 8 ("Inst. Dec.").

After institution, Patent Owner filed a Response (Paper 23, "PO Resp.") to the Petition, Petitioner filed a Reply (Paper 27, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 32, "PO Sur-reply").[1] An oral hearing was held on December 7, 2021, and a transcript of the hearing is included in the record. Paper 42 ("Tr.").

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, Petitioner has met its burden of showing, by a preponderance of the evidence, that challenged claims 1–7 and 20–28 of the '554 patent are unpatentable.

B. Related Proceedings

The parties identify the following matters related to the '554 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

[1] After the Sur-reply was filed, we authorized Petitioner to file an Identification of Testimony. Paper 38.

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (also challenging claims 1–28 of the '554 patent);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2); and

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2).

Pet. 3–4; Paper 5, 1–3.

Patent Owner further identifies the following pending patent applications, among other issued and abandoned applications, that claim priority to, or share a priority claim with, the '554 patent:

U.S. Patent Application No. 16/834,538;

U.S. Patent Application No. 16/449,143; and

U.S. Patent Application No. 16/805,605.

Paper 5, 1–2.

C. The '554 Patent

The '554 patent is titled "Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents," and issued on March 17, 2020, from U.S. Patent Application No. 16/544,713, filed August 19, 2019. Ex. 1001, codes (21), (22), (45), (54). The '554 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The '554 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:38–40. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:29–35, 64–65. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:45–48.

Figure 1 of the '554 patent is reproduced below.

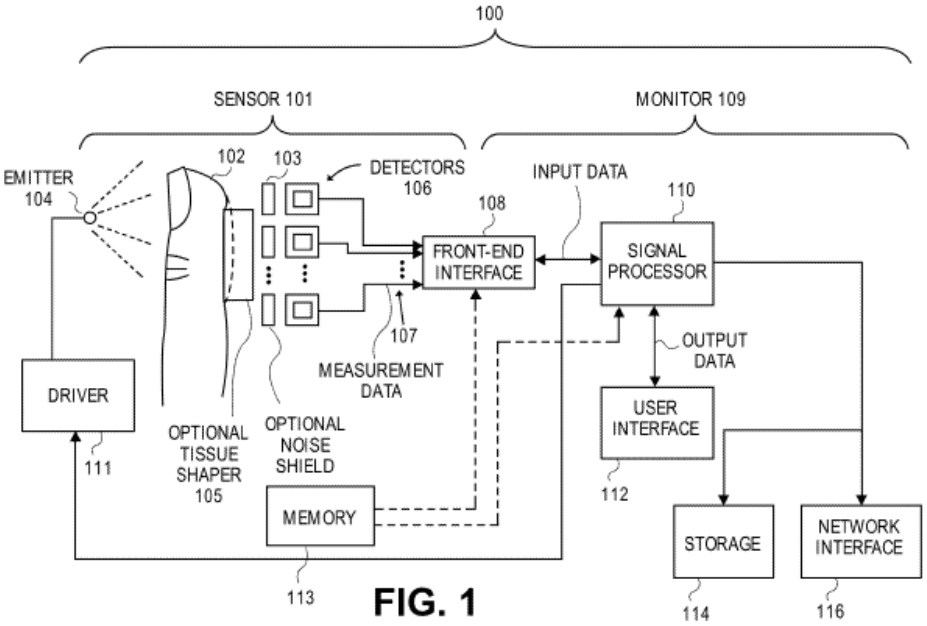


FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:47–58. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* at 11:59–63. Emitters 104 emit light that is attenuated or reflected by the patient's tissue at measurement site 102. *Id.* at 14:3–7. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signals 107 to monitor 109 through front-end interface 108. *Id.* at 14:7–10, 26–32. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient's measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 11:2–14.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:16–18. "[S]ignal processor 110 includes processing logic that determines measurements for desired analytes . . . based on the signals received from the detectors." *Id.* at 15:21–24. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:46–56. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:60–16:11.

The '554 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate detector portions of sensor devices.

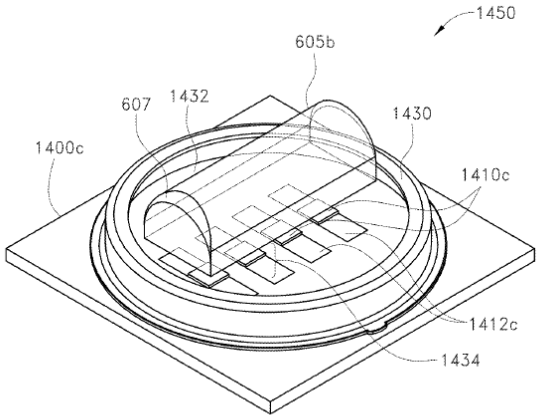


FIG. 14D

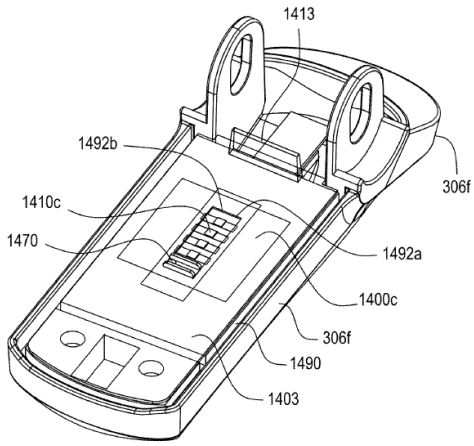


FIG. 14F

Figure 14D illustrates portions of a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:44–47. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:36–39, 36:30–37. Figure 14F illustrates a detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 37:9–17. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:47–48.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

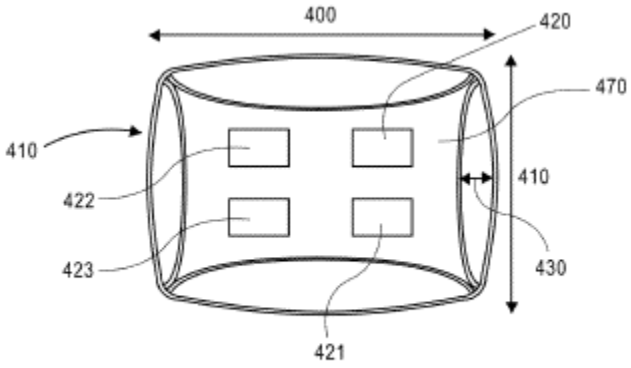


FIG. 4A

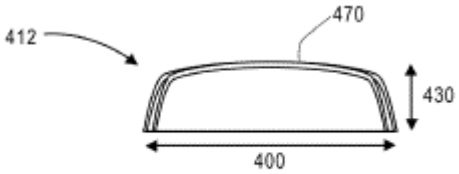


FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:18–24. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:39–43. The measurement site contact area may include windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:49–63.

D. Illustrative Claim

Of the challenged claims, claims 1 and 20 are independent. Claim 1 is illustrative and is reproduced below.

1. A physiological measurement system comprising:

[a] a physiological sensor device comprising:

[b] a plurality of emitters configured to emit light into tissue of a user;

[c] at least four detectors, wherein each of the at least four detectors has a corresponding window that allows light to pass through to the detector;

[d] a wall that surrounds at least the at least four detectors; and

[e] a cover that operably connects to the wall and that is configured to be located between tissue of the user and the at least four detectors when the physiological sensor device is worn by the user, wherein:

[f] the cover comprises a single protruding convex surface, and

[g] at least a portion of the cover is sufficiently rigid to cause tissue of the user to conform to at least a portion of a shape of the single protruding convex surface when the physiological sensor device is worn by the user; and

[h] a handheld computing device in wireless communication with the physiological sensor device, wherein the handheld computing device comprises:

[i] one or more processors configured to wirelessly receive one or more signals from the physiological sensor device, the one or more signals responsive to at least a physiological parameter of the user;

[j] a touch-screen display configured to provide a user interface,

wherein:

[k] the user interface is configured to display indicia responsive to measurements of the physiological parameter, and

[l] an orientation of the user interface is configurable responsive to a user input; and

[m] a storage device configured to at least temporarily store at least the measurements of the physiological parameter.

Ex. 1001, 44:51–45:21 (bracketed identifiers a–m added). Independent claim 20 includes limitations substantially similar to limitations [a]–[h] of claim 1. *Id.* at 46:31–52.

E. Applied References

Petitioner relies upon the following references:

> Mendelson, U.S. Patent No. 6,801,799 B2, filed February 6, 2003, issued October 5, 2004 (Ex. 1012, "Mendelson-799");
>
> Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1009, "Ohsaki");
>
> Schulz et al., U.S. Patent Application Publication No. 2004/0054291 A1, filed July 31, 2003, published March 18, 2004 (Ex. 1013, "Schulz"); and
>
> Y. Mendelson et al., "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," Proceedings of the 28th IEEE EMBS Annual International Conference, 912–915 (2006) (Ex. 1010, "Mendelson-2006").

Pet. 12.

Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003) and the Second Declaration of Dr. Thomas W. Kenny (Ex. 1047). Patent Owner submits, *inter alia*, the Declaration of Dr. Vijay K. Madisetti (Ex. 2004). The parties also provide deposition testimony from Dr. Kenny and Dr. Madisetti, including from this proceeding and others. *See* Exs. 1041–1043, 2006–2009, 2027.

F. Asserted Ground of Unpatentability

We instituted an *inter partes* review based on the following ground. Inst. Dec. 9, 32.

Claims Challenged	35 U.S.C. §	References/Basis
1–7, 20–28	103	Mendelson-799, Ohsaki, Schulz, Mendelson-2006

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019). Petitioner submits that no claim term requires express construction. Pet. 11. Patent Owner submits that claim terms should be given their ordinary and customary meaning, consistent with the Specification. PO Resp. 9–10.

We agree that no claim terms require express construction. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103(a) if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine

[2] Patent Owner has not presented objective evidence of non-obviousness.

whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must support its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person "having a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 10–11 (citing Ex. 1003 ¶¶ 1–18, 20–21). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.* at 11.

Patent Owner makes several observations regarding Petitioner's identified level of skill in the art but, "[f]or purposes of this proceeding,

[Patent Owner] nonetheless applies Petitioner's asserted level of skill." PO Resp. 10.

We adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Mendelson-799, Ohsaki, Schulz, and Mendelson-2006

Petitioner contends that claims 1–7 and 20–28 of the '554 patent would have been obvious over the combined teachings of Mendelson-799, Ohsaki, Schulz, and Mendelson-2006. Pet. 43–96; *see also generally* Pet. Reply. Patent Owner disagrees. PO Resp. 12–63; *see also generally* PO Sur-reply.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of the evidence that claims 1–7 and 20–28 are unpatentable.

1. Overview of Mendelson-799 (Ex. 1012)

Mendelson-799 is a U.S. patent titled "Pulse Oximeter and Method of Operation," and discloses a sensor for non-invasive measurement of a blood parameter, which includes a sensor housing, a radiation source, and a detector. Ex. 1012, codes (54), (57).

Figure 7 of Mendelson-799 is reproduced below.

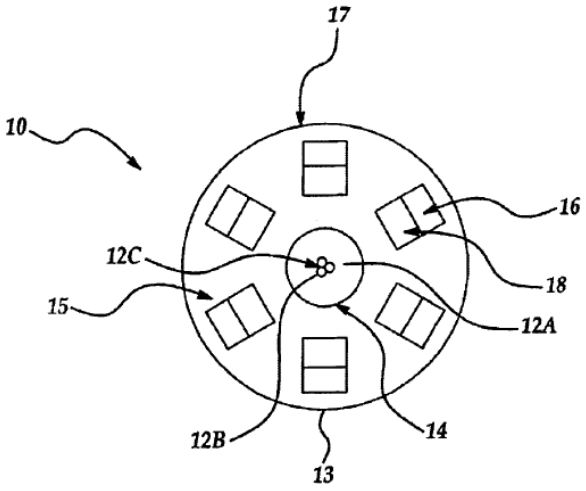


Figure 7

Figure 7 illustrates optical sensor 10 with light source 12, which includes three closely spaced light emitting elements 12a, 12b, 12c. *Id.* at 9:22–28. Optical sensor 10 includes an array of discrete detectors, i.e., "far" detectors 16 and "near" detectors 18, "arranged in two concentric ring-like arrangements . . . surrounding the light emitting elements." *Id.* at 9:29–34. "[L]ight shield 14 is positioned between the photodiodes and the light emitting elements, and prevents direct optical coupling between them, thereby maximizing the fraction of backscattered light passing through the arterially perfused vascular tissue in the detected light." *Id.* at 9:35–40. Sensor housing 17 accommodates the light source, light shield, and detectors. *Id.* at 9:34–35.

Figure 8 of Mendelson-799 is reproduced below.

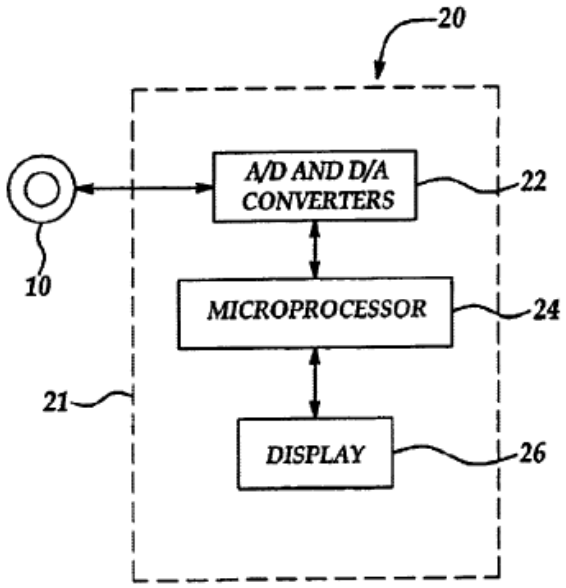


Figure 8

Figure 8 illustrates a block diagram of pulse oximeter 20 using sensor 10. *Id.* at 10:16–17. Pulse oximeter 20 includes control unit 21, with electronic block 22 connectable to sensor 10, microprocessor 24, and display 26, which presents measurement results. *Id.* at 10:17–22. "The measured data (i.e., electrical output of the sensor 10 indicative of the detected light) is directly processed in the block 22, and the converted signal 25 is further processed by the microprocessor 24." *Id.* at 10:22–25.

2. Overview of Ohsaki (Ex. 1009)

Ohsaki is a U.S. patent application publication titled "Wristwatch-type Human Pulse Wave Sensor Attached on Back Side of User's Wrist," and discloses an optical sensor for detecting a pulse wave of a human body. Ex. 1009, code (54), ¶ 3.

Figure 1 of Ohsaki is reproduced below.

FIG. 1

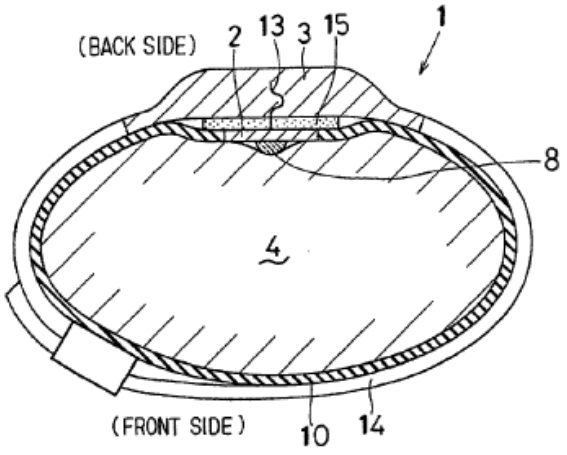


Figure 1 illustrates a cross-sectional view of pulse wave sensor 1 attached on the back side of user's wrist 4. *Id.* ¶¶ 12, 16. Pulse wave sensor 1 includes detecting element 2 and sensor body 3. *Id.* ¶ 16.

Figure 2 of Ohsaki, reproduced below, illustrates further detail of detecting element 2.

FIG. 2

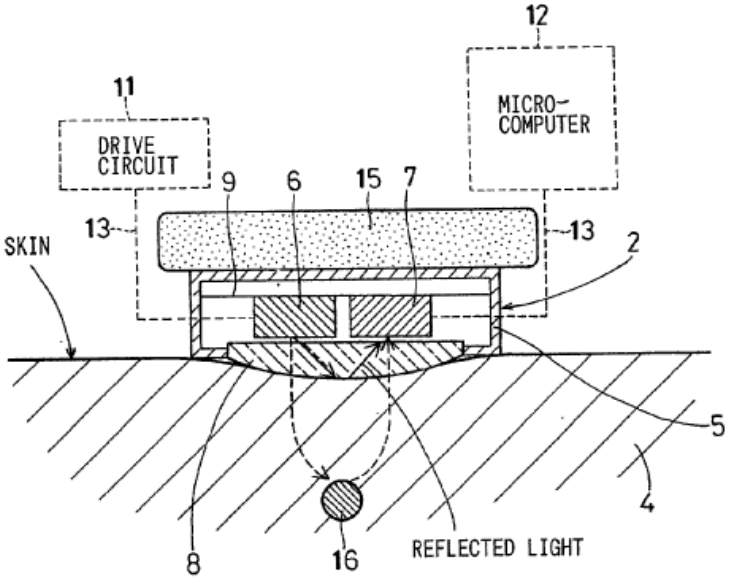


Figure 2 illustrates a mechanism for detecting a pulse wave. *Id.* ¶ 13. Detecting element 2 includes package 5, light emitting element 6, light receiving element 7, and translucent board 8. *Id.* ¶ 17. Light emitting element 6 and light receiving element 7 are arranged on circuit board 9 inside package 5. *Id.* ¶¶ 17, 19.

"[T]ranslucent board 8 is a glass board which is transparent to light, and attached to the opening of the package 5. A convex surface is formed on the top of the translucent board 8." *Id.* ¶ 17. "[T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin," preventing detecting element 2 from slipping off the detecting position of the user's wrist. *Id.* ¶ 25. By preventing the detecting element from moving, the convex surface suppresses "variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin." *Id.* Additionally, the convex surface prevents penetration by "noise such as disturbance light from the outside." *Id.*

Sensor body 3 is connected to detecting element 2 by signal line 13. *Id.* ¶ 20. Signal line 13 connects detecting element 2 to drive circuit 11, microcomputer 12, and a monitor display (not shown). *Id.* Drive circuit 11 drives light emitting element 6 to emit light toward wrist 4. *Id.* Detecting element 2 receives reflected light which is used by microcomputer 12 to calculate pulse rate. *Id.* "The monitor display shows the calculated pulse rate." *Id.*

3. Overview of Schulz (Ex. 1013)

Schulz is a U.S. patent application publication titled "Pulse Oximetry Ear Sensor," and discloses an ear sensor assembly including an emitter pad and a detector pad. Ex. 1013, codes (54), (57).

Figure 19C of Schulz is reproduced below.

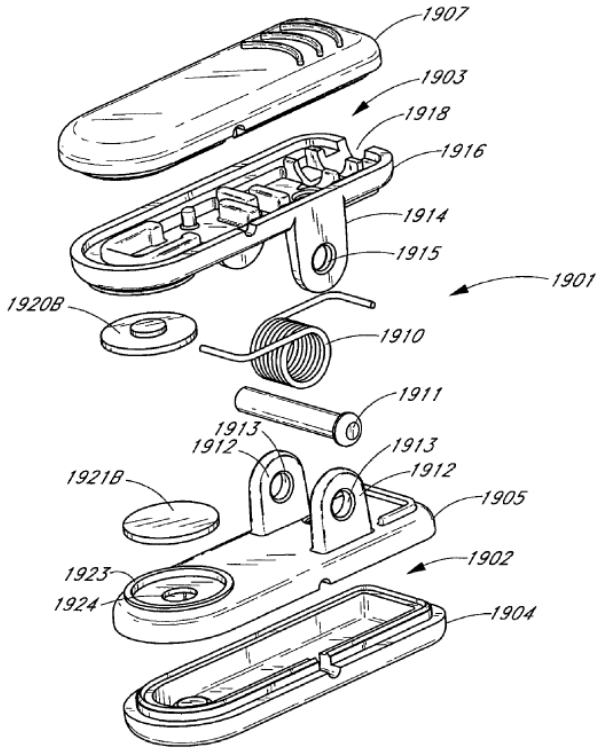


Figure 19C illustrates an exploded top perspective view of an ear sensor clip. *Id.* ¶ 31. Each sensor clip 1900 includes "opposingly positioned housings 1902 and 1903 that house one or more sensor optical components." *Id.* ¶ 65. Each housing includes respective inward facing shells 1905 and 1906.[3] *Id.* ¶ 65. "[I]nward facing shells 1905 and 1906 further include windows 1919 and 1924 that provide an aperture for transmission of optical

[3] Figure 19C appears to label inward facing shell 1906 as 1916. *See id.* at Fig. 19B.

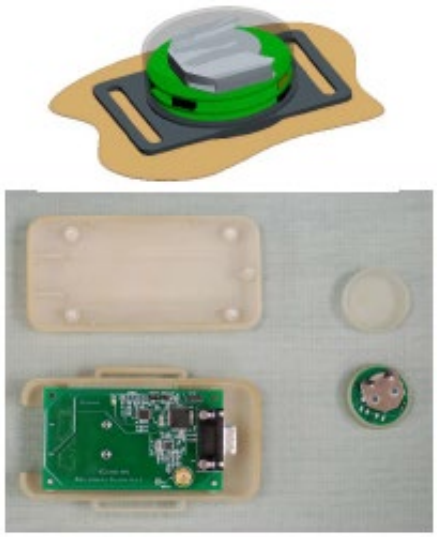
energy to or from a tissue site. Translucent silicone material covers windows 1919 and 1924 providing lenses 1920 and 1921." *Id.* ¶ 67.

A "thin sheet of opaque material is located beneath window 1919 or 1924, and a window in the opaque material provides an aperture for transmission of optical energy to or from the tissue site." *Id.* ¶ 73. "The opaque material blocks light, and the window in the opaque material can be sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector." *Id.*

4. Mendelson-2006 (Ex. 1010)

Mendelson-2006 is a journal article titled "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," and discloses a wireless wearable pulse oximeter connected to a personal digital assistant ("PDA"). Ex. 1010, 1.[4]

Figure 1 of Mendelson-2006 is reproduced below.



[4] Petitioner cites to the page numbers added to Exhibit 1010, rather than the native page numbering that accompanies the article. *See, e.g.*, Pet. 23–25. We follow Petitioner's numbering scheme.

Figure 1 illustrates a sensor module attached to the skin (top), and a photograph of a disassembled sensor module and receiver module (bottom). The sensor module includes an optical transducer, a stack of round printed circuit boards, and a coin cell battery. *Id.* at 2.

Figure 2 of Mendelson-2006 is reproduced below.

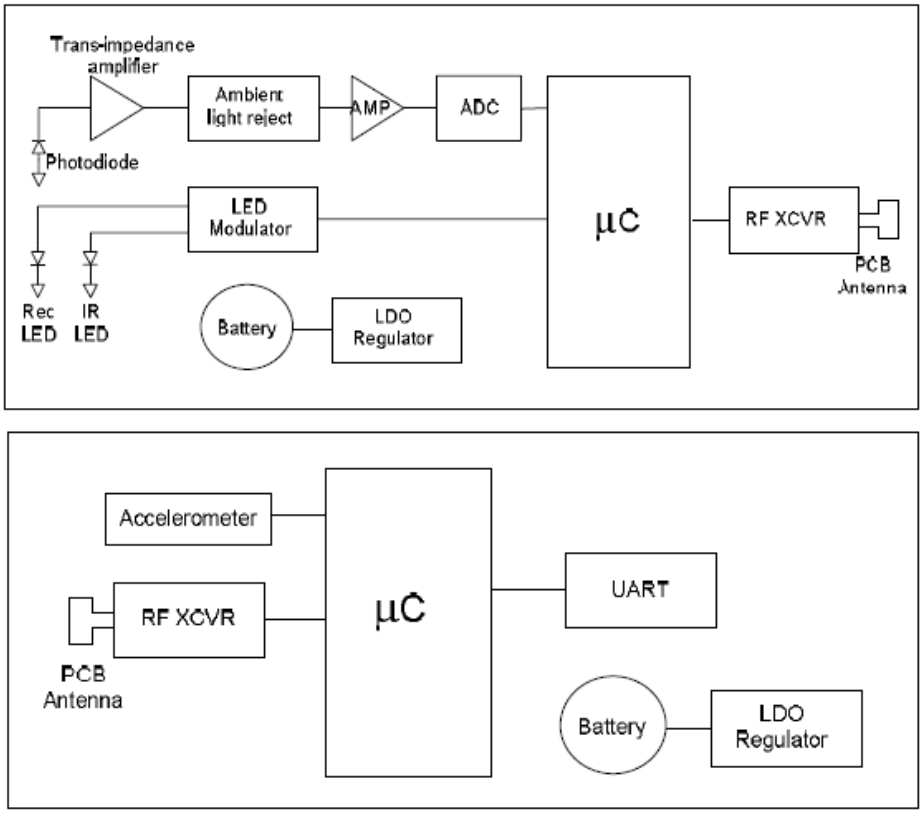


Figure 2 depicts a system block diagram of the wearable, wireless, pulse oximeter including the sensor module (top) and the receiver module (bottom). *Id.* The sensor module includes at least one light-emitting diode ("LED"), a photodetector, signal processing circuitry, an embedded microcontroller, and an RF transceiver. *Id.* at 1–2. Mendelson-2006 discloses that a concentric array of discrete photodetectors could be used to increase the amount of backscattered light detected by a reflectance type pulse oximeter sensor. *Id.* at 4. The receiver module includes an embedded

microcontroller, an RF transceiver for communicating with the sensor module, and a wireless module for communicating with the PDA. *Id.* at 2.

As a PDA for use with the system, Mendelson-2006 discloses "the HP iPAQ h4150 PDA because it can support both 802.11b and Bluetooth™ wireless communication" and "has sufficient computational resources." *Id.* at 3. Mendelson-2006 further discloses that

> [t]he use of a PDA as a local terminal also provides a low-cost touch screen interface. The user-friendly touch screen of the PDA offers additional flexibility. It enables multiple controls to occupy the same physical space and the controls appear only when needed. Additionally, a touch screen reduces development cost and time, because no external hardware is required. . . . The PDA can also serve to temporarily store vital medical information received from the wearable unit.

Id.

The PDA is shown in Figure 3 of Mendelson-2006, reproduced below.

Figure 3 illustrates a sample PDA and its graphical user interface ("GUI"). *Id.* Mendelson-2006 explains that the GUI allows the user to interact with the wearable system. *Id.* "The GUI was configured to present the input and output information to the user and allows easy activation of various functions." *Id.* "The GUI also displays the subject's vital signs, activity

level, body orientation, and a scrollable PPG waveform that is transmitted by the wearable device." *Id.* For example, the GUI displays numerical oxygen saturation ("SpO_2") and heart rate ("HR") values. *Id.*

5. Independent Claim 1

Petitioner contends that claim 1 would have been obvious over the combined teachings of Mendelson-799, Ohsaki, Schulz, and Mendelson-2006. Pet. 43–69. Below, we set forth how the combination of prior art references teaches or suggests the claim limitations that are not disputed by the parties. For those limitations and reasons for combining the references that are disputed, we examine each of the parties' contentions and then provide our analysis.

i. "A physiological measurement system comprising"

The cited evidence supports Petitioner's undisputed contention that the combination of Mendelson-799, Ohsaki, Schulz, and Mendelson-2006 satisfies the subject matter of the preamble.[5] Pet. 43–45; *see, e.g.*, Ex. 1012, code (57), 7:25–8:13, 8:37–41, 9:22–40, 10:16–22, Fig. 7 (sensor device), 8; Ex. 1010, 1–4, Fig. 3 (handheld computing device); Ex. 1003 ¶¶ 102–115.

ii. "[a] a physiological sensor device comprising"

The cited evidence supports Petitioner's undisputed contention that Mendelson-799 discloses a physiological sensor device including sensor 10 and pulse oximeter 20. Pet. 46; *see, e.g.*, Ex. 1012, code (57) ("A sensor for use in an optical measurement device."), 9:22–40 (describing sensor 10), 10:16–30 (describing pulse oximeter 20, including sensor 10), Figs. 7–8.

[5] Whether the preamble is limiting need not be resolved because Petitioner shows sufficiently that the preamble's subject matter is satisfied by the art.

iii. "[b] a plurality of emitters configured to emit light into tissue of a user"

The cited evidence supports Petitioner's undisputed contention that Mendelson-799 discloses a plurality of light emitting elements 12a–c that emit light into a user's tissue. Pet. 46–47; *see, e.g.*, Ex. 1012, 9:22–40 ("The sensor 10 comprises . . . light source 12 composed of three closely spaced light emitting elements (e.g., LEDs or laser sources) 12a, 12b and 12c generating light of three different wavelengths."), Fig. 7.

iv. "[c] at least four detectors, wherein each of the at least four detectors has a corresponding window that allows light to pass through to the detector"

Petitioner's Undisputed Contentions

Petitioner contends that Mendelson-799 discloses twelve photodetectors located within a sensor housing. Pet. 48. Patent Owner does not dispute this contention, and we agree with Petitioner. Mendelson-799 discloses that "sensor 10 comprises . . . an array of discrete detectors (e.g., photodiodes)," including six far detectors 16 and six near detectors 18. *See, e.g.*, Ex. 1012, 9:22–40, Fig. 7.

Petitioner does not contend that Mendelson-799 discloses the claimed windows. Rather, Petitioner contends that Schulz teaches "a sensor featuring 'a thin sheet of opaque material' placed inside the sensor's housing . . . with 'a window in the opaque material provid[ing] an aperture for transmission of optical energy to or from the tissue site," wherein the opaque material blocks light and avoids saturation of the sensor's detectors. Pet. 32 (quoting Ex. 1013 ¶ 73). Patent Owner does not dispute this contention, and we agree with Petitioner. Schulz discloses that a "thin sheet of opaque material" can be placed between the optical components of the sensor and

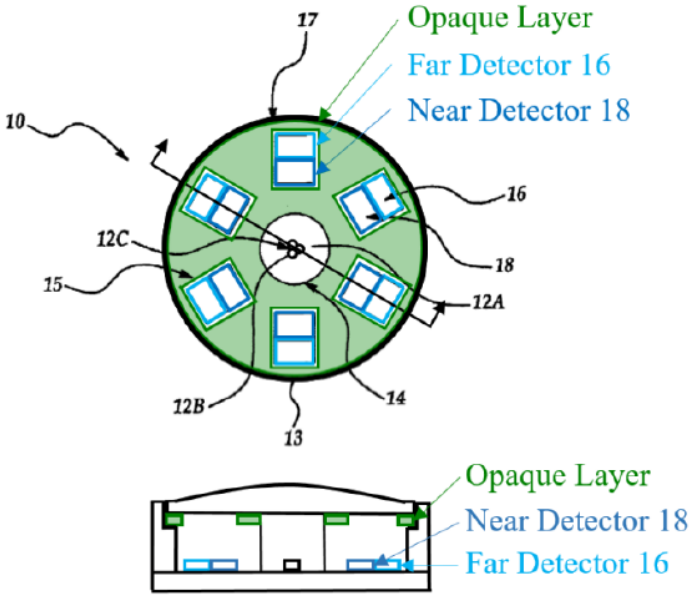
the sensor's housing. Ex. 1013 ¶ 73. Schulz explains that the opaque material includes a window that allows for transmission of optical energy to the detector. *Id.* According to Schulz, the "opaque material blocks light, and the window in the opaque material can be sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector." *Id.*

Petitioner's Disputed Contentions

Petitioner further contends that a person of ordinary skill in the art would have been motivated "to add a layer of opaque material" to Mendelson-799's sensor, as taught by Schulz, "and to size windows in the opaque material as appropriate to avoid saturation of each of the sensor's detectors." Pet. 33 (citing, e.g., Ex. 1003 ¶¶ 93–101), 49 (citing, e.g., Ex. 1003 ¶¶ 122–131). According to Petitioner, errors are reduced by minimizing the amount of ambient light that reaches the detectors, for example, by decreasing the angle of incidence to the detectors. *Id.* at 33 (citing Ex. 1019, 76, 79–80, 94). Petitioner contends that a person of ordinary skill in the art would have understood that "Schulz's opaque layer limits errors by decreasing the angle of incidence to the photodiode to that enabled by the window included within the layer, and by otherwise preventing ambient light from reaching the photodiode." *Id.* at 34 (citing, e.g., Ex. 1003 ¶¶ 93–97). Petitioner also contends that a skilled artisan would have recognized that, when applying Schulz's teachings to a sensor with multiple detectors, multiple windows would have been employed. *Id.* at 34 (citing, e.g., Ex. 1003 ¶ 98).

To illustrate its proposed modification, Petitioner includes an annotated and modified view of Mendelson-799's Figure 7, as well as an

added sectional view, both of which are reproduced below. Pet. 36; *see also id.* at 49 (similar figures with slightly different annotations); Ex. 1003 ¶100.



Petitioner's modified figure and added sectional view depict the sensor of Mendelson-799 with an added opaque layer (illustrated in green) having windows, as Petitioner contends would have been rendered obvious by Schulz.[6] Pet. 49.

Patent Owner's Arguments

Patent Owner argues that a person of ordinary skill in the art would not have been motivated to modify Mendelson-799 as proposed because adding an opaque layer would *decrease* signal strength, especially for a reflectance pulse oximeter like Mendelson-799, which Patent Owner alleges has a weak signal already. PO Resp. 47–48 (citing, e.g., Ex. 2004 ¶¶ 83–84); PO Sur-reply 23–24. According to Patent Owner, Schulz uses the

[6] Petitioner's annotated figures also include an added opaque wall and an added top cover as discussed *infra* at Sections II.D.5.v and II.D.5.vi.

window in the opaque material only to reduce "desired" light to a "proper" level, i.e., only to reduce the light generated by the emitter that passes through the user's tissue before reaching the detector, but the window in the opaque material does not reduce *ambient* light. PO Resp. 50 ("Schulz uses a separate cover—not the window [in the opaque material]—to block ambient light.") (citing Ex. 1013 ¶ 41); PO Sur-reply 21–23 (citing, e.g., Ex. 2004 ¶¶ 83–88). Thus, according to Patent Owner, use of a windowed opaque material in Mendelson-799's sensor would make its weak signal even weaker by limiting the light from the emitter. PO Sur-reply 23. Patent Owner argues that decreasing signal strength in this way would have been inconsistent with Petitioner's additional modification to add a convex cover to the sensor of Mendelson-799, to *increase* signal strength. PO Resp. 47–48; PO Sur-reply 26; *see infra* § II.D.5.vi.

Moreover, Patent Owner argues that the motivation put forth by Petitioner—to avoid saturation—is not shown to have been a problem for the sensor of Mendelson-799. PO Resp. 47. Patent Owner also argues that there were "easier approaches for addressing saturation of the detectors," such as "adjusting gain or LED brightness." *Id.* at 48.

Patent Owner also argues aspects of Schulz individually. For example, Patent Owner argues that Schulz is directed to an ear sensor, and that there are physiological differences in measurement locations that are not accounted for by Petitioner. PO Resp. 49 (citing, e.g., Ex. 2004 ¶ 85). Additionally, Patent Owner argues that Schulz discloses only a single window, not multiple windows as claimed. *Id.*; PO Sur-reply 26.

Finally, Patent Owner criticizes Petitioner's reliance on additional evidence that does not form part of the asserted ground. *Id.* at 51–52 (citing, e.g., Ex. 1019; Ex. 1023; Ex. 2004 ¶¶ 89–91).

Analysis

We have considered the parties' arguments and cited evidence, and we are persuaded by Petitioner's contentions. As discussed above, Schulz explicitly teaches that its opaque material and window "blocks light" and "avoid[s] saturation of the light detector." Ex. 1013 ¶ 73. Petitioner cites persuasive and well-supported evidence, including the testimony of its declarant, that a person of ordinary skill in the art would have been motivated to add such an arrangement to the sensor of Mendelson-799 to achieve this same disclosed benefit, i.e., to avoid saturation of Mendelson's detectors. *See, e.g.*, Ex. 1003 ¶¶ 95–96. For example, Dr. Kenny's testimony regarding the ability of an opaque material with windows to avoid saturation is supported by Schulz and by the Webster textbook, which discusses the importance of minimizing "light other than the optical signals of interest." *Id.* ¶ 96 (citing Ex. 1019, 76). We are persuaded by Petitioner's contentions and Dr. Kenny's testimony.

We do not agree with Patent Owner's argument that this modification would *decrease* signal strength. PO Resp. 47–48. We discern that Petitioner's proposed modification would not alter the signal of interest, i.e., the optical signal that passes from the emitter, through the user's tissue, and to the photodetectors. Rather, the cited evidence of record supports Petitioner's contention that the proposed modification would have blocked light *other than* that from the signal of interest, i.e., that the modification would have block light *other than* that from the emitter. *See, e.g.*, Ex. 1003

¶ 100 ("Schulz would have motivated one of ordinary skill to modify the sensor . . . to further include an opaque layer that would have *blocked light other than at windows corresponding to the sensor's photodiodes*.") (emphasis added); Ex. 1013 ¶ 73 ("The opaque material blocks light, and the window in the opaque material can be sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector."); *see also* Pet. Reply 21–22. Thus, we do not agree that the proposed modification would have decreased signal strength.

We have considered Patent Owner's argument that Schulz uses the opaque material to reduce only "desired" light to a "proper" level, i.e., to reduce light from the emitter that passes through the user's tissue, to avoid saturation. PO Resp. 50; PO Sur-reply 22–23 (citing, e.g., Ex. 2004 ¶¶ 83–88). We do not find any support for this argument in Schulz. To the contrary, Schulz explains that "the window in the opaque material can be sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector." Ex. 1013 ¶ 73. Contrary to Patent Owner's argument, Schulz simply states that its window is sized to control the amount of light *that enters the aperture*; Schulz does not state where that light comes from, or that it only controls against light from the emitter. Patent Owner identifies no basis in Schulz's disclosure to conclude that Schulz's emitter operates at a level that would saturate the detector, absent the addition of an opaque material. *See also* Pet. Reply 25–26. Likewise, we do not find any support for this argument in the cited portions of Dr. Madisetti's declaration. *See, e.g.*, Ex. 2004 ¶ 88 (concluding, without persuasive explanation, that Schulz's window blocks

light only from the emitter, not ambient light); *but see, e.g.*, Ex. 1043, 28:11–18 (agreeing that ambient light is an example of interfering noise).

We also do not agree with Patent Owner's argument that Petitioner has not shown that saturation was a problem for Mendelson-799's sensor. PO Resp. 47. Mendelson-799 need not identify a problem with saturation in order to be improved by the proposed modification. Indeed, Petitioner "does not need to show that there was a known problem with the prior art system." *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002–03 (Fed. Cir. 2016); *see also Sci. Plastic Prods., Inc. v. Biotage AB*, 766 F.3d 1355, 1359–61 (Fed. Cir. 2014); *Hologic, Inc. v. Minerva Surgical, Inc.*, 764 F. App'x 873, 880 (Fed. Cir. 2019). As expressly recognized in *KSR*, *any* art-recognized need or problem can provide a reason for combining claim elements. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). Here, Petitioner provides sufficient evidence to demonstrate that saturation was a known problem (*see, e.g.*, Ex. 1003 ¶ 96; Ex. 1019, 79;[7] Ex. 1047 ¶ 47) and that Schulz provided a readily-applicable technique to solve it (Ex. 1013 ¶ 73). That "easier approaches" may have existed, *see* PO Resp. 48, does not teach away from the approach explicitly taught by Schulz.

We also do not agree with Patent Owner's argument that Schulz and Mendelson-799 are incompatible because they obtain measurements at different locations. Mendelson-799 explains that its sensor type can be used in "multiple convenient locations on the body," and does not exclude use on

[7] It is of no moment that this evidence is not identified as part of the asserted ground. PO Resp. 51–52. This evidence is cited by Dr. Kenny as support for his testimony, consistent with our rules. 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.").

a patient's ear or elsewhere. Ex. 1012, 2:15–21; *contra* PO Resp. 49; *see also* Ex. 1019, 104 ("The idea of using skin reflectance spectrophotometry marked a significant advancement in the noninvasive monitoring of S_aO_2 from virtually any point on the skin surface."). Moreover, the proposed modification does not seek to bodily incorporate the references, one with the other. Rather, Petitioner clearly proposes modifying Mendelson-799 to include an opaque material with windows, as taught by Schulz, but plainly does not propose incorporating any other aspect of Schulz, such as its measurement location. *See* Pet. 47–49; *see also In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the teachings of references does not involve an ability to combine their specific structures.").

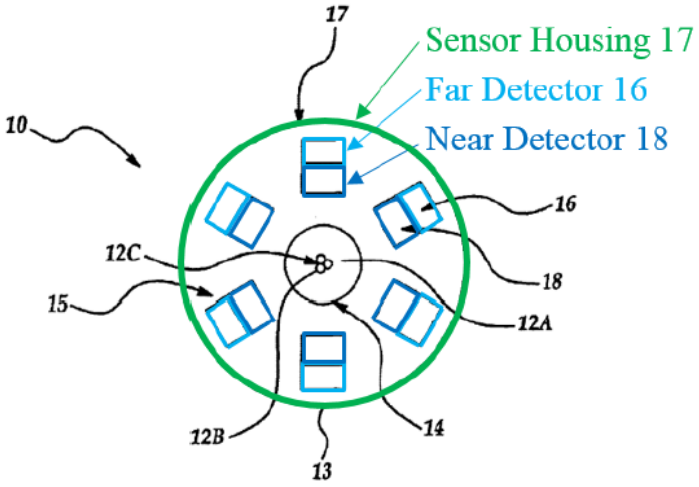
We have considered the remainder of Patent Owner's arguments, but we do not agree with them. For example, it is irrelevant that Schulz teaches only a single window, because Petitioner provides persuasive testimony to show that a skilled artisan would have implemented a window for *each detector* in Mendelson-799's sensor. PO Resp. 49; Ex. 1003 ¶¶ 98–100. It is likewise irrelevant that Schulz discloses an additional "separate cover . . . to block ambient light," because the presence of a separate cover does not change the fact that Schulz explicitly teaches using its windowed opaque material to avoid detector saturation. *See* Ex. 1013 ¶ 73; *contra* PO Resp. 50; PO Sur-reply 21–22.

For the foregoing reasons, we are persuaded by Petitioner's contentions.

v. "[d] a wall that surrounds at least the at least the four detectors"

The cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 50–53. Specifically, Petitioner contends that

Mendelson-799 discloses sensor housing 17 that encircles detectors 16, 18, as shown below in Petitioner's annotated and modified view of Mendelson-799's Figure 7. *Id.* at 50–51; *see, e.g.*, Ex. 1012, 9:23–40 ("All these elements are accommodated in a sensor housing 17."), Fig. 7.



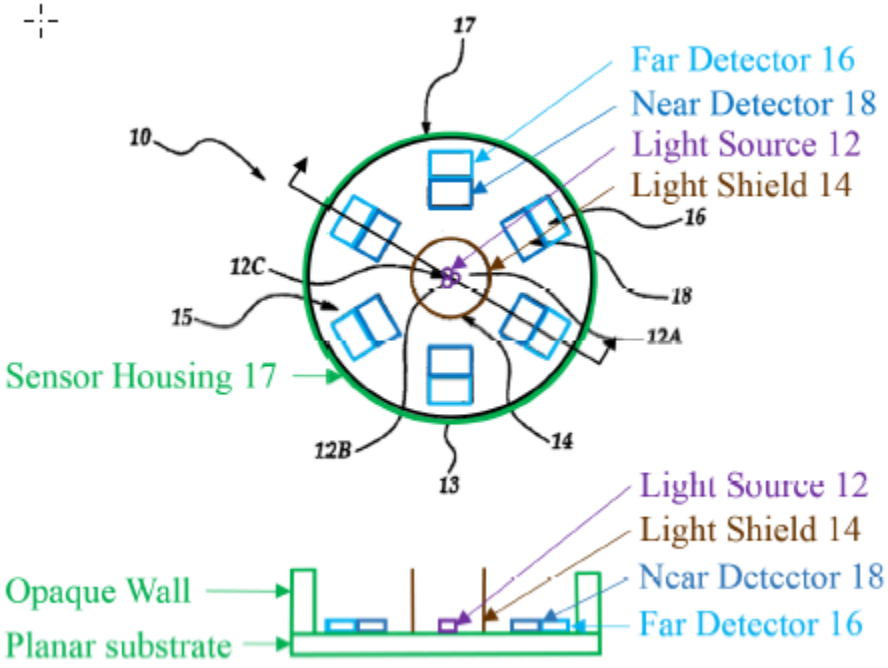
Petitioner's modified figure depicts the sensor of Mendelson-799 with sensor housing 17 identified in green and encircling the detectors.

Petitioner acknowledges that Mendelson-799 does not depict a side view of the sensor and thus, to the extent Mendelson-799 does not explicitly teach that housing 17 includes an opaque wall that surrounds the detectors, a person of ordinary skill in the art would have found it obvious "to connect, to the illustrated portion of sensor housing 17, an opaque wall configured to circumscribe the array of discrete detectors," to shield the detectors from ambient light and to protect from external forces. Pet. 14–15, 24–25, 50–52; *see, e.g.*, Ex. 1003 ¶¶ 63, 69, 82, 134.

Petitioner contends this is consistent with the purpose of Mendelson-799's light shield 14, which prevents the emitters' light from reaching the detectors directly (Pet. 15 (citing Ex. 1012, 9:35–40)), as well as other prior art references cited in Mendelson-799 (*id.* at 15–17 (citing Exs. 1017,

1018)). *See, e.g.*, Ex. 1003 ¶¶ 64–68, 135–139. For example, Petitioner states that Ohsaki discloses that sensor package 5 includes a wall that surrounds light emitting element 6 and light receiving element 7. Pet. 52; *see, e.g.*, Ex. 1009 ¶ 17, Fig. 2; Ex. 1003 ¶¶ 140–141.

To illustrate its proposed modification, Petitioner includes an annotated and modified view of Mendelson-799's Figure 7, as well as an added sectional view, both of which are reproduced below. Pet. 18; *see also id.* at 26 (same), 52 (similar figures with slightly different annotations).



Petitioner's modified and added figures depict the sensor of Mendelson-799 with an added opaque wall (illustrated in green) connected to the planar substrate of housing 17 and encircling the sensor components, as Petitioner contends would have been obvious to a person of ordinary skill in the art. *Id.* at 18, 50–51; Ex. 1003 ¶¶ 82, 142–143.

Patent Owner does not dispute Petitioner's contentions regarding this limitation. *See generally* PO Resp.; PO Sur-reply.

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny, who testifies that such a wall would "shield the detectors from ambient light, and protect the detectors from external forces." Ex. 1003 ¶ 136; *see also* Ex. 1003 ¶¶ 63–71, 82, 132–144.

vi. "[e–g] a cover that operably connects to the wall and that is configured to be located between tissue of the user and the at least four detectors when the physiological sensor device is worn by the user, wherein: the cover comprises a single protruding convex surface, and at least a portion of the cover is sufficiently rigid to cause tissue of the user to conform to at least a portion of a shape of the single protruding convex surface when the physiological sensor device is worn by the user"

Petitioner's Undisputed Contentions

Petitioner contends that Mendelson-799 does not disclose a cover located between the user's tissue and the four detectors, as claimed. Pet. 26–27. Patent Owner does not dispute this contention, and we agree that Mendelson-799 is not shown to include a cover. *See generally* Ex. 1012.

Petitioner relies upon Ohsaki for the recited cover, and contends that:

> Ohsaki discloses a wrist-worn "pulse wave sensor" that includes a light permeable convex cover—"translucent board 8"—that is configured to be located between user tissue and a detector when the sensor is worn, where the cover comprises a single protruding convex surface operable to conform [to] tissue of the user, and where a wall operably connects to a substrate and to the cover.

Pet. 27–28, 53–55 (citing, e.g., Ex. 1009 ¶¶ 15, 17, 25; Ex. 1003 ¶ 86). Patent Owner does not dispute this contention, and we agree with Petitioner. Ohsaki discloses that sensor 1 is "worn on the back side of the user's wrist" and includes translucent board 8, with a single convex surface formed on the top of the board, to be placed against a user's tissue. Ex. 1009 ¶¶ 16, 17,

Figs. 1–2 (depicting translucent board 8 between tissue and detector). As shown in Ohsaki's Figure 2, the board 8 is operably connected to the walls of sensor package 5 that houses the sensor components, including circuit board 9, light emitting element 6 (e.g., LED), and light receiving element 7. *Id.* ¶ 17 ("The translucent board 8 is . . . attached to the opening of the package 5."), Fig. 2.

Petitioner also contends that the user's tissue conforms to the shape of the convex surface, such that a person of ordinary skill in the art would have understood the convex surface to be "sufficiently rigid." Pet. 55–57. Patent Owner does not dispute this contention, and we agree with Petitioner. As depicted in Ohsaki's Figure 2, the user's tissue 4 is shown to conform to the shape of the protruding convex surface when the sensor is worn by the user. Ex. 1009 ¶ 17 ("The translucent board 8 is a glass board."), Fig. 2; *see, e.g.*, Ex. 1003 ¶ 160 (testifying as to the convex surface's rigidity).

Petitioner's Disputed Contentions

Petitioner further contends that a person of ordinary skill in the art "would have recognized that a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, "would improve adhesion between the sensor and the user's tissue, improve detection efficiency, and protect the elements within sensor housing 17." Pet. 26 (citing, e.g., Ex. 1003 ¶ 84; Ex. 1009 ¶¶ 15, 17, 25), 29–30. Petitioner contends that Ohsaki's convex surface is in intimate contact with the user's tissue, which prevents slippage of the sensor and increases signal strength because "variation of the amount of the reflected light . . . that reaches the light receiving element 7 is suppressed" and "disturbance light from the outside"

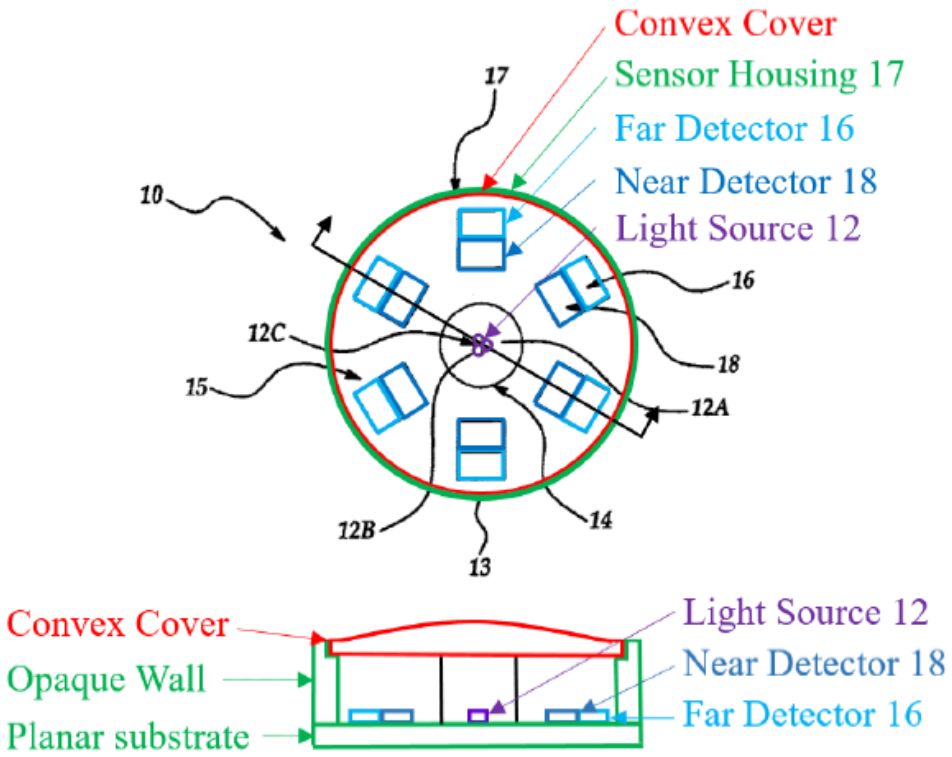
is prevented from penetrating board 8, as compared to a sensor with a flat surface. *Id.* at 28–29 (citing, e.g., Ex. 1003 ¶ 87; quoting Ex. 1009 ¶ 25).

Accordingly, Petitioner contends that, to achieve these identified benefits, a person of ordinary skill in the art "would have added a transparent convex cover to [Mendelson-799's] sensor 10, the cover being located between tissue of the user and the array of detectors 16 and 18 when worn." Pet. 30 (citing, e.g., Ex. 1003 ¶ 91; Ex. 1009 ¶¶ 15, 17, 25). Petitioner also contends that an ordinarily skilled artisan would have "configured the cover to be sufficiently rigid to conform tissue of the user to at least a portion of the cover's surface when worn." *Id.* (citing, e.g., Ex. 1009 ¶ 30). Additionally, Petitioner contends the skilled artisan would have "configured Mendelson-799's circumscribing wall to operably connect" to the sensor's planar substrate and to the convex cover. Pet. 30–31; *see also id.* at 53–57 (citing, e.g., Ex. 1003 ¶ 91).

Petitioner contends these modifications would have been "nothing more than the use of a known technique to improve similar devices in the same way, and combining prior art elements according to known methods to yield predictable results—improved adhesion of the sensor to the user's skin, and improved signal strength," where "the elements of the resulting sensor would each perform functions they had been known to perform prior to the combination—a cover would simply be placed over the components accommodated within Mendelson-799's sensor housing 17, and would perform the same function as taught by Ohsaki." *Id.* at 31–32 (citing, e.g., Ex. 1003 ¶¶ 84–92).

To illustrate its proposed modification, Petitioner includes an annotated and modified view of Mendelson-799's Figure 7, as well as an

added sectional view, both of which are reproduced below. Pet. 31 (citing Ex. 1003 ¶¶ 84–92); *see also id.* at 54 (same).



Petitioner's modified and added figures depict the sensor of Mendelson-799 with an added convex cover (illustrated in red) connected to the wall of Mendelson-799's sensor (illustrated in green, *see supra* § II.D.5.v). Pet. 30–31, 54–55; *see, e.g.*, Ex. 1003 ¶¶ 153–154.

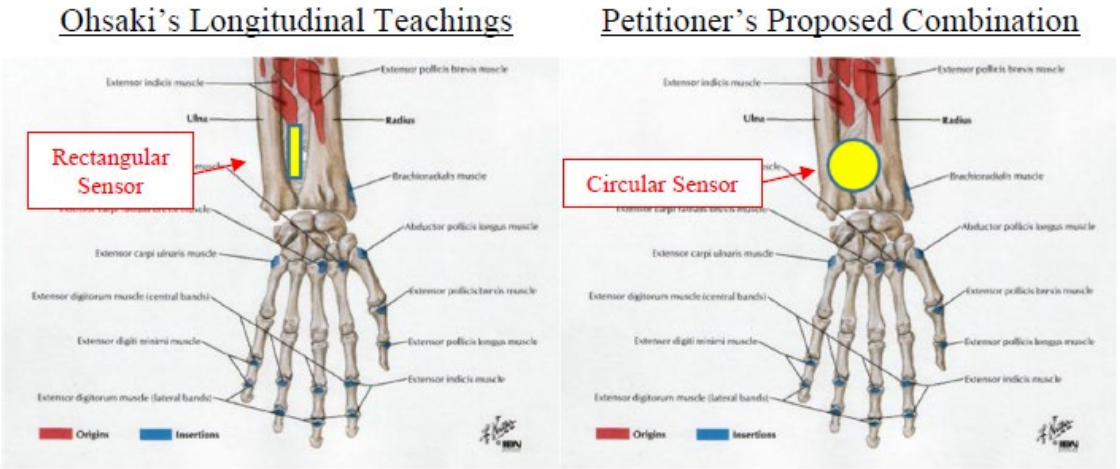
Patent Owner's Arguments

Patent Owner argues that a person of ordinary skill in the art would not have been motivated to modify Mendelson-799's sensor to include Ohsaki's convex cover. PO Resp. 23–47; PO Sur-Reply 2–21.

First, Patent Owner argues that the proposed modification "changes Ohsaki's structure and eliminates the longitudinal shape that gives Ohsaki's translucent board the ability to fit within the user's anatomy and prevent slipping." PO Resp. 23. This argument is premised on Patent Owner's

contention that Ohsaki's convex cover must be rectangular, with the cover's long direction aligned with the length of the user's forearm, to avoid interacting with bones in the wrist and forearm. *Id.* at 24–25 (citing, e.g., Ex. 2004 ¶¶ 51–54; Ex. 1009 ¶¶ 6, 19, 23, 24); *see also* PO Sur-reply 2–10. According to Patent Owner, Ohsaki teaches that "aligning the sensor's longitudinal direction with the circumferential direction of the user's arm undesirably results in 'a tendency [for Ohsaki's sensor] to slip off.'" PO Resp. 25–26 (citing Ex. 1009 ¶ 19), 27–28.

Thus, Patent Owner contends that Petitioner's proposed modification would "chang[e] Ohsaki's rectangular board into a circular shape," which "would eliminate the advantages discussed above" because it "cannot be placed in any longitudinal direction and thus cannot coincide with the longitudinal direction of the user's wrist." *Id.* at 26 (citing Ex. 2004 ¶¶ 55–56). Patent Owner presents annotated Figures depicting what it contends is Ohsaki's disclosed sensor placement as compared to that of the proposed modification, reproduced below.



Patent Owner's annotated Figure on the left depicts a rectangular sensor placed between a user's radius and ulna, while Patent Owner's annotated

Figure on the right depicts a circular sensor placed across a user's radius and ulna. Based on these annotations, Patent Owner argues that the proposed "circular shape would press on the user's arm in all directions and thus cannot avoid the undesirable interaction with the user's bone structure," such that a skilled artisan "would have understood such a change would eliminate Ohsaki's benefit of preventing slipping." *Id.* at 27–28 (citing, e.g., Ex. 2004 ¶¶ 55–58).

Second, Patent Owner argues that Ohsaki requires its sensor be placed on the back of the user's wrist to achieve any benefits, but that such a location would have been unsuitable for Mendelson-799's sensor, and would result in weak sensor signals. PO Resp. 32. Relying on other publications by the named inventor on Mendelson-799, Patent Owner alleges that sensor signals were difficult or impossible to discern from the wrist, even with considerable pressure. *Id.* (citing Ex. 2003, 3–4); *see also id.* at 33–34 (citing Ex. 2015, 3, 4; Ex. 2014, 1, 99). Patent Owner contends that Dr. Kenny admitted that signals from the wrist are weaker and noisier than from other locations. *Id.* at 33 (citing Ex. 2008, 249:10–16, 255:12–21); *see also id.* at 34–37 (citing Ex. 2017, 2; Ex. 2018, 4; Ex. 2010, 44, 71; Ex. 2016, 2, 3).

Third, Patent Owner argues that a person of ordinary skill in the art would not have placed Ohsaki's convex cover over Mendelson-799's peripheral detectors because the convex cover would condense light toward the center and away from the detectors, which would decrease signal strength. PO Resp. 38–43 (citing, e.g., Ex. 2004 ¶¶ 71–76). Patent Owner also contends that Petitioner and Dr. Kenny admit as much, fail to account for the impact of the proposed modification on light collection, and fail to

propose a specific three-dimensional structure to embody the proposed modification. *Id.* at 38–43 (citing, e.g., Ex. 2020, 69–70; Ex. 2006, 204:14–20; Ex. 2008, 36:19–37:1, 57:19–58:16, 63:5–64:8, 170:12–171:1, 173:8–15). Patent Owner relies on Figure 14B of the '554 patent, which Patent Owner contends supports its position. *Id.* at 39–40 (citing Ex. 1001, 36:3–6, 36:13–15).

Fourth, Patent Owner argues that Ohsaki's rectangular cover creates air gaps at its peripheral edges, as shown in Ohsaki's Figure 1, which Mendelson-799 cautions against as potentially causing "specular reflection." PO Resp. 43–44 (citing, e.g., Ex. 1012, 2:58–64). Accordingly, Patent Owner argues that a person of ordinary skill in the art "would not have modified Mendelson[-]799's structure to add Ohsaki's air gaps." *Id.* at 44 (citing Ex. 2004 ¶¶ 77–78).

Fifth, Patent Owner argues that "a convex cover is just one of many different alternatives for protecting the components of a sensor" including, e.g., resin or encapsulation. PO Resp. 45–46. Concerning possible alternatives, Patent Owner contends that a person of ordinary skill in the art "would have understood that a flat cover would provide better protection than a convex surface because—as Petitioner's cited art teaches—a flat cover would be less prone to scratches." *Id.* at 46–47 (citing Ex. 1008 ¶ 106).

Petitioner's Reply

Concerning Patent Owner's first and second arguments, Petitioner responds that Ohsaki does not disclose the shape of its protrusion, other than its convexity as shown in Figures 1 and 2, nor does Ohsaki require a rectangular shape or placement on the back of the wrist in order to achieve

the disclosed benefits. Pet. Reply 7–12 (citing, e.g., Ex. 1047 ¶¶ 17–30). Moreover, Petitioner asserts that "even if Ohsaki's translucent board 8 were somehow understood to be rectangular, obviousness does not require 'bodily incorporation' of features from one reference into another"; rather, a person of ordinary skill in the art "would have been fully capable of attaching a light permeable protruding convex cover to Me[nd]elson-799's housing to obtain the benefits attributed to such a cover by Ohsaki." *Id.* at 10 (citing, e.g., Ex. 1047 ¶ 23). Similarly, regarding the location of the sensor, Petitioner asserts,

> [E]ven if a [person of ordinary skill in the art] would have somehow misunderstood Ohsaki's sensor as limited to placement on the backside of the wrist, and even if the difficulty that [Patent Owner] alleges with respect to obtaining pulse oximetry measurements from that location were true, that would have further motivated the [person of ordinary skill in the art] to implement a light permeable convex cover in Mendelson-799's sensor, to improve detection efficiency.

Id. at 11 (citing, e.g., Ex. 1047 ¶ 26).

Concerning Patent Owner's third argument, Petitioner responds that adding a convex cover to Mendelson-799's sensor would not decrease signal strength but, instead, "would improve Mendelson-799's signal-to-noise ratio by causing more light backscattered from tissue to strike Mendelson-799's detectors than would have absent the cover" because such a cover improves light concentration across the entire lens and does not direct it only towards the center. *Id.* at 13–17 (citing, e.g., Ex. 1047 ¶¶ 31–45).

Petitioner dismisses Patent Owner's reliance on Figure 14B of the '554 patent because it "is not an accurate representation of light that has been reflected from a tissue measurement site. For example, the light rays

(1420) shown in FIG. 14B are collimated (i.e., travelling paths parallel to one another), and each light ray's path is perpendicular to the detecting surface." Pet. Reply 13–14 (citing, e.g., Ex. 1047 ¶¶ 32–34). Moreover, Petitioner argues that, even when collimated, light will focus at the center "only if the light beam happens to be perfectly aligned with the axis of symmetry of the lens" and, when entering at any other angle, will focus at a different point. *Id.* at 15 (citing, e.g., Ex. 1047 ¶ 35).

According to Petitioner, Patent Owner's and Dr. Madisetti's position regarding convergence toward the center does not apply to diffuse light, which reaches the detectors from various random angles and directions after having been reflected by tissue. *Id.* at 15–16 (citing, e.g., Ex. 1047 ¶ 36). As a result, Petitioner contends Ohsaki's cover would have provided a refracting effect such that light rays that would have missed the detectors absent a cover are instead directed to that area as they pass through the cover. *Id.* at 16–17 (citing Ex. 1047 ¶¶ 37–39). Petitioner thus contends that "overall, more of the partially reflected, transmitted, absorbed, and ultimately back scattered light strikes the detectors than otherwise would have absent the cover." *Id.* at 17 (citing Ex. 1047 ¶¶ 32–40).

Concerning Patent Owner's fourth argument, Petitioner responds that a skilled artisan would have known to avoid air gaps in the proposed combination. *Id.* at 18 (citing, e.g., Ex. 1047 ¶¶ 41–43).

Concerning Patent Owner's fifth argument, Petitioner responds that even if a flat surface might be less prone to scratching, that possible disadvantage would have been weighed against the "multiple advantages of a convex cover," and would not negate a motivation to combine. *Id.* at 19 (citing, e.g., Ex. 1047 ¶ 45).

Patent Owner's Sur-reply

Concerning Patent Owner's first and second arguments, Patent Owner reiterates its position that Ohsaki's purported benefits attach only to a sensor with a rectangular convex surface that is located on the back of the wrist, and that "even small changes in sensor orientation or measurement location result in slippage." PO Sur-reply 3–14, 7.

Concerning Patent Owner's third argument, Patent Owner argues that Dr. Kenny and Petitioner have not overcome their admissions that a convex lens directs light toward the center. *Id.* at 15–16 (citing, e.g., Ex. 2004 ¶¶ 72–76).

Patent Owner also asserts that Petitioner mischaracterizes Patent Owner's position, which is not that a convex cover focuses "***all*** light" to a single point at the center of the sensor. *Id.* at 16. Patent Owner instead states that, "[l]ight entering the convex surface from all angles would, on average, result in more light directed towards the center and less light at the periphery—as compared to a flat surface—and therefore less light at the peripherally located detectors." *Id.* at 17 (citing Ex. 2004 ¶¶ 71–75).

Finally, Patent Owner argues that Petitioner's Reply arguments are overly complex and instead a person of ordinary skill in the art "would have understood and applied the straightforward understanding that a convex surface condenses light toward the center." *Id.* at 18–19.

Concerning Patent Owner's fourth argument, Patent Owner argues that "Petitioner does not dispute that . . . air gaps would dissuade a [person of ordinary skill in the art] from modifying Mendelson[-]799." *Id.* at 19.

Concerning Patent Owner's fifth argument, Patent Owner argues that Petitioner does not dispute Patent Owner's position that a flat cover would be less prone to scratches and offers "***no*** plausible advantages for its asserted combination." *Id.* at 22. Moreover, Patent Owner argues that "the risk of scratches is not merely a disadvantage—it directly undermines Petitioner's motivation to add a convex cover to 'protect the elements within the sensor housing.'" *Id.*

Analysis

As noted above, Petitioner provides three rationales to support its contention that a person of ordinary skill in the art would have provided "a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, to Mendelson-799's sensor: (1) to "improve adhesion between the sensor and the user's tissue," (2) to "improve detection efficiency," and (3) to "protect the elements within sensor housing 17." Pet. 26 (citing, e.g., Ex. 1003 ¶ 84; Ex. 1009 ¶¶ 15, 17, 25), 29–30. We conclude all three rationales are supported by the evidence, as follows.

Rationales 1 and 2

The evidence of record persuades us that a person of ordinary skill in the art would have been motivated to add a convex cover, such as that taught by Ohsaki, to improve adhesion between the sensor and the user's skin, which would have increased the signal strength of the sensor. Ohsaki teaches as much:

> [T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin. Thereby *it is prevented that the detecting element 2 slips off* the detecting position of the user's wrist 4. If the translucent board 8 has a flat surface, the detected pulse wave is adversely affected by the

> movement of the user's wrist 4 as shown in Fig. 4B. However, in the case that the translucent board 8 has a convex surface like the present embodiment, the *variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed*. *It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8*. Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1009 ¶ 25 (emphasis added); *see also id.* ¶ 27 ("stably fixed").

We credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated by such teachings to apply a cover with a convex surface to Mendelson-799 to improve that similar device in the same way and to yield predictable results, i.e., to resist movement of the sensor on the user's wrist. *See, e.g.*, Ex. 1003 ¶ 87 ("[T]his contact between the convex surface and the user's skin is said to prevent slippage, which increases the strength of the signals obtainable by Ohsaki's sensor."). We also credit Dr. Kenny's testimony that, in light of these teachings, a person of ordinary skill in the art would have made such a modification to improve the pulse sensor's ability to emit light into, and detect light reflected from, the user's wrist, to generate an improved pulse signal. Ex. 1003 ¶¶ 88–89, 149–150; Ex. 1047 ¶ 12.

Indeed, Ohsaki expressly compares the performance of a wrist-worn pulse wave sensor depending on whether translucent board 8 is convex or flat, and concludes the convex surface results in improved performance over the flat surface, especially when the user is moving. Ex. 1009, Figs. 4A–4B, ¶¶ 15, 25 (stating that with "a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist 4," and with "a

convex surface like the present embodiment, the variation of the amount of the reflected light" collected by the sensor "is suppressed"). Ohsaki also states that, with a convex surface, "[i]t is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8." *Id.* ¶ 25.

We also credit Dr. Kenny's testimony that the proposed modification would have been within the level of ordinary skill in the art. For example, Dr. Kenny testifies:

> The above-described modification would require only routine knowledge of sensor design and assembly, which were well within the skill of one of ordinary skill prior to the Critical Date. Indeed, the modification would have amounted to nothing more than the use of a known technique to improve similar devices in the same way, and combining prior art elements according to known methods to yield predictable results—improved adhesion of the sensor to the user's skin, and improved signal strength. Furthermore, the elements of the resulting sensor would each perform functions they had been known to perform prior to the combination—Ohsaki's translucent board 8 would simply be placed over the components accommodated within Mendelson '799's sensor housing 17, and would perform the same function as taught by Ohsaki.

Ex. 1003 ¶ 92; *see also id.* ¶¶ 88–92, 154. In light of Ohsaki's express disclosure of the benefits of a convex cover, we credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to modify Mendelson-799 as proposed, and would have had a reasonable expectation of success in doing so.

We next address Patent Owner's first through fourth arguments, each of which implicates Petitioner's first and second asserted rationales of improved adhesion and detection efficiency.

Patent Owner's first argument is premised on the notion that Ohsaki's benefits only can be realized with a rectangular convex surface, because such a shape is required to avoid interacting with bones on the back of the user's forearm. PO Resp. 23–28. We disagree. Ohsaki does not disclose the shape of its convex cover, much less require it be rectangular. In fact, Ohsaki is silent as to the shape of the convex surface. Ohsaki discloses that sensor 1 includes detecting element 2, which includes package 5 within which the sensor components are located. *Id.* ¶ 17. Ohsaki's convex surface is located on board 8, which is "attached to the opening of the package 5." *Id.* Ohsaki provides no further discussion regarding the shape of board 8 or its convex surface.

We disagree with Patent Owner's suggestion that the shape of the convex surface can be inferred to be rectangular from Ohsaki's Figures 1 and 2. PO Resp. 17–18. Ohsaki does not indicate that these figures are drawn to scale, or reflect precise dimensions or shapes of the convex surface. *See, e.g.*, Ex. 1009 ¶ 13 ("schematic diagram"); *see also* Pet. Reply 9; *Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956 (Fed. Cir. 2000) ("[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.").

To be clear, Ohsaki describes the shape of *detecting element 2* as rectangular: "[T]he length of the detecting element from the right side to the left side in FIG. 2 is longer than the length from the upper side to the lower side." *Id.* ¶ 19. Ohsaki also describes that detecting element 2 is aligned longitudinally with the user's forearm: "[I]t is desirable that the detecting element 2 is arranged so that its longitudinal direction agrees with the

longitudinal direction of the user's arm," to avoid slipping off. *Id.*; *see also id.* ¶ 9 ("The light emitting element and the light receiving element are arranged in the longitudinal direction of the user's arm.").

In light of this disclosed rectangular shape of detecting element 2, it is certainly possible that Ohsaki's convex surface may be similarly shaped. But, it may not be. Contrary to Patent Owner's argument, Ohsaki neither describes nor requires detecting element 2 to have the same shape as the convex surface of board 8. *Accord* Pet. Reply. 7–8 (noting also that Ohsaki's board 8 "is not coextensive with the entire tissue-facing side of detecting element 2"). We have considered the cited testimony of both Dr. Kenny and Dr. Madisetti on this point. Ex. 1047 ¶¶ 10–12, 12 n.2, 17–23; Ex. 2004 ¶¶ 38–41 (relying on Ohsaki's Figures 1–2 to support his opinion that the convex surface is rectangular). Dr. Madisetti's reliance on the dimensions of Ohsaki's figures is unpersuasive. *Hockerson-Halberstadt*, 222 F.3d at 956. We credit Dr. Kenny's testimony that Ohsaki does not describe its convex surface as rectangular, because this testimony is most consistent with Ohsaki's disclosure.

Further, Patent Owner suggests that the convex surface *must be* rectangular, in order to avoid interacting with bones in the user's forearm. PO Resp. 28; PO Sur-Reply 9 ("[A] POSITA would have understood Ohsaki's convex board must also have a longitudinal shape oriented up-and-down the watch-side of the user's wrist/forearm."). Although Ohsaki recognizes that interaction with these bones can cause slippage problems, *see* Ex. 1009 ¶¶ 6, 19, we do not agree that the *only way* to avoid these bones is by aligning a rectangular cover with the longitudinal direction of the user's forearm. For example, in the annotated Figures provided by Patent

Owner, *see* PO Resp. 27–28, we discern that the circular sensor that purports to depict the proposed modification would *also* avoid the bones in the forearm if it were slightly smaller. Patent Owner provides no persuasive explanation to justify the dimensions it provides in this annotated figure, or to demonstrate that such a large sensor would have been required. Indeed, we discern that it would have been within the level of skill of an ordinary artisan to appropriately size a modified sensor to avoid these well-known anatomical obstacles. "A person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 421. After all, an artisan must be presumed to know something about the art apart from what the references disclose. *See In re Jacoby*, 309 F.2d 513, 516 (CCPA 1962).

Finally, we do not agree with Patent Owner's position that Ohsaki's advantages apply only to rectangular convex surfaces. As discussed, Patent Owner has not shown that Ohsaki's convex surface is rectangular at all. Moreover, even if Ohsaki's convex surface is rectangular, when discussing the benefits associated with a convex cover, Ohsaki does not limit those benefits to a cover of any particular shape. Instead, Ohsaki explains that "detecting element 2 is arranged on the user's wrist 4 so that the convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin. Thereby it is prevented that the detecting element 2 slips off the detecting position of the user's wrist 4." Ex. 1009 ¶ 25; Ex. 1047 ¶ 10. Thus, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a surface to Mendelson-799's circular-shaped sensor, to improve adhesion as taught by Ohsaki. *See, e.g.*, Pet. 26–28. Nothing in Ohsaki's disclosure

limits such a benefit to a specific shape of the convex surface. Ex. 1047 ¶¶ 11–12.

Moreover, Ohsaki contrasts its convex surface with a flat surface and notes that,

> in the case that the translucent board 8 has a convex surface . . . the variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8. Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1009 ¶ 25; Ex. 1047 ¶ 11. Thus, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a surface to Mendelson-799's sensor, to improve signal strength, as taught by Ohsaki. *See, e.g.*, Pet. 26–28. Again, nothing in Ohsaki's disclosure limits such a benefit to the shape of the convex surface. Ex. 1047 ¶¶ 11–12.

Accordingly, we do not agree that Ohsaki's disclosed advantages attach only to a rectangular convex surface, or would have been inapplicable to the proposed combination of Mendelson-799 and Ohsaki.[8]

We have considered Patent Owner's second argument, that Ohsaki's benefits are realized only when the sensor and convex surface are placed on

[8] Patent Owner also argues that, to the extent contended by Petitioner, it would not have been obvious to place a rectangular cover on top of Mendelson-799's sensor. PO Resp. 29–31. We do not understand Petitioner to have made any such contention and, accordingly, do not address this argument. *See, e.g.*, Pet. 31, 54 (depicting circular convex surface over circular sensor).

the back of the user's wrist, which is an unsuitable location for Mendelson-799's sensor. PO Resp. 32–38. We do not agree. As an initial matter, Petitioner does not propose bodily incorporating the references; Petitioner simply proposes adding a convex cover to Mendelson-799's sensor, without discussing where Mendelson-799's sensor is used. *See, e.g.*, Pet. 30. In other words, Petitioner's proposed modification does not dictate any particular placement. Moreover, Mendelson-799 states that its sensor "allows for measuring SaO_2 from multiple convenient locations on the body (e.g. the head, torso, or upper limbs)." Ex. 1012, 2:17–19; *see also* Ex. 1019, 104 ("The idea of using skin reflectance spectrophotometry marked a significant advancement in the noninvasive monitoring of S_aO_2 from virtually any point on the skin surface."). Thus, we do not agree that Mendelson-799 discourages or disparages use on the back of the wrist.

Notwithstanding the foregoing, and assuming for sake of argument that Patent Owner is correct that a person of ordinary skill in the art would have expected a weaker signal from Mendelson-799's sensor if placed on the wrist, *see* PO Resp. 32, that alone does not nullify the proposed combination. "[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (citation omitted). Indeed, we discern that, if Mendelson-799's sensor was placed at a location that results in decreased signal quality, a person of ordinary skill in the art would have been further motivated to act to improve signal quality, e.g., by employing Ohsaki's convex surface. *See, e.g.*, Ex. 1047 ¶¶ 27–30; Ex. 1009 ("[I]n the case that the translucent board 8 has a convex surface like the present embodiment, the variation of the amount of

the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8.").

We have considered Patent Owner's third argument that a convex cover would condense light away from Mendelson-799's peripheral detectors, which Patent Owner alleges would decrease signal strength. PO Resp. 38–43. We disagree. There appears to be no dispute that when emitted light that passes through user tissue, the light is diffused and scattered as it travels. *See, e.g.*, Pet. Reply 13–17; Tr. 27:18–28:3 (Petitioner's counsel agreeing that "the incoming light from a detection standpoint is going to be coming from all sorts of different directions because of the randomness caused by the back scattering"), 65:23–66:13 (Patent Owner's counsel agreeing that light does not simply enter tissue and come back out "like it came out on a mirror"); Ex. 1041, 35:19–37:18 (Patent Owner's declarant describing light scattering as it travels through tissue, e.g., reflecting off blood, tissue, or other material); Ex. 1043, 28:2–10 (Patent Owner's declarant agreeing that reflecting light can be a signal for the '554 patent's sensor), 61:20–62:4 (explaining that "a light in this context, light emitted from the LEDs is diffused through the skin in that particular context, whatever that is."). The light thus travels at random angles and directions, and no longer travels in a collimated and perpendicular manner.

Dr. Kenny testifies that Mendelson-799 and Ohsaki "detect light that has been 'partially reflected, transmitted, absorbed, and scattered by the skin and other tissues and the blood before it reaches the detector." Ex. 1047 ¶ 37. Dr. Kenny further opines that, "the POSITA would have understood

that Mendelson-799's sensor, which includes multiple photodiodes placed symmetrically with respect to a central light source, offers the advantage of *enabling a large fraction of light randomly backscattered from tissue to be detected within the circular active detection area surrounding that source*," thus increasing the light-gathering ability of Mendelson-799's sensor. *Id.* ¶ 38 (emphasis added); *see also id.* ¶ 39 ("Ohsaki's cover provides a refracting effect, such that light rays that otherwise would have missed the detection area are instead directed toward that area as they pass through the interface provided by the cover.").

By contrast Dr. Madisetti testifies that "a convex surface condenses light away from the periphery and towards the sensor's center." Ex. 2004 ¶ 74. We have considered this testimony; however, Dr. Madisetti's opinions largely are premised upon the behavior of collimated and perpendicular light as depicted in Figure 14B of the challenged patent. *See id.* Dr. Madisetti does not explain how light would behave when approaching the sensor from various angles, as it would after being reflected by tissue. *Id.* ¶¶ 72–76. In other words, even if Patent Owner is correct that the '554 patent's Figure 14B depicts light condensing toward the center, this is not dispositive to the proposed modification, because light passing through a user's tissue is scattered and random, and is not collimated and perpendicular as shown in Figure 14B. Ex. 1001, Fig. 14B.

Patent Owner and Dr. Madisetti argue that "Petitioner and Dr. Kenny both previously admitted that a convex cover condenses light towards the center of the sensor and away from the periphery in a different petition filed against a related patent," i.e., in IPR2020-01520. PO Resp. 38–39; Ex. 2004 ¶¶ 72–73 (citing Ex. 2019, 45; Ex. 2020 ¶¶ 118–120). The cited portions of

the Petition and Dr. Kenny's declaration from IPR2020-01520 discuss a decrease in the "mean path length" of a ray of light when it travels through a convex lens rather than through a flat surface. *See, e.g.*, Ex. 2020 ¶¶ 118–120. We do not agree that this discussion is inconsistent with Dr. Kenny's testimony here that, where light is reflected to the detectors at various random angles and directions, more light will reach Mendelson-799's symmetrically disposed detectors when travelling through the convex surface than would be reached without such a surface, because light that might have otherwise missed the detectors now will be captured. Ex. 1047 ¶¶ 37–40. We do not discern that the convergence of a single ray of light toward the center, as discussed in IPR2020-01520, speaks to the aggregate effect on *all* light that travels through the convex surface. Patent Owner suggests that this prior discussion means that all light is always directed toward the center regardless of where or how the light approaches the convex surface, however, we do not understand Dr. Kenny's testimony to support such a position. PO Resp. 38–39.

In its Sur-reply, Patent Owner argues that it "never argued that ***all*** light focuses at the center." PO Sur-reply 15–16. Be that as it may, neither Patent Owner nor Dr. Madisetti sufficiently address the diffuse nature of the light at issue here, which reflects from user tissue and scatters. Patent Owner attempts to do so in its Sur-reply, stating that "light entering the convex surface from all angles would, on average, result in more light directed towards the center and less light at the periphery—as compared to a flat surface—and therefore less light at the peripherally located detectors." *Id.* at 17. However, as support, Patent Owner identifies only the same portions of Dr. Madisetti's declaration discussed above, which fail to

address diffuse or scattered light. Ex. 2004 ¶¶ 71–75. Accordingly, considering all evidence of record, we credit the testimony of Dr. Kenny.[9]

With respect to Patent Owner's fourth argument, we do not agree that a person of ordinary skill in the art would have been discouraged from modifying Mendelson-799 as proposed, due to the potential for air gaps to form at the peripheral edges of the convex surface. PO Resp. 43–45. Patent Owner misstates the proposed modification. Petitioner does not propose "modif[ying] Mendelson[-]799's structure to add Ohsaki's air gaps." *Contra* PO Resp. 44. Petitioner proposes modifying Mendelson-799 only to include a cover with a convex surface; Petitioner does not propose including any air gaps that may be present in Ohsaki. *See, e.g.*, Pet. 53. Moreover, even if Ohsaki's Figure 1 depicts small air gaps adjacent the convex surface, Ohsaki nonetheless discloses that the convex surface is in "intimate contact" with the user's skin. Ex. 1009 ¶ 25; *see also Hockerson-Halberstadt*, 222 F.3d at 956. In view of such a teaching, we agree with Petitioner that it would have been within the skill of a person of ordinary skill in the art, who "is also a person of ordinary creativity, not an automaton," to minimize any such air gap that may be present when including a cover with a convex surface in Mendelson-799's sensor. Indeed, a purpose of Petitioner's proposed modification is to increase signal strength. *See, e.g.*, Pet. 27. We discern that it would have been within the capability of an ordinarily skilled

[9] Moreover, we disagree with Patent Owner's argument that Petitioner's Reply arguments are overly complex and instead a person of ordinary skill in the art "would have understood and applied the straightforward understanding that a convex surface condenses light toward the center." PO Sur-reply 18–19. As noted above, this "straightforward understanding" lacks sufficient support, in the context of diffuse light.

artisan to eliminate any air gap that would have decreased signal strength or quality. Ex. 1047 ¶ 43.

Rationale 3

Petitioner further contends that a person of ordinary skill in the art "would have recognized that a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, would "protect the elements within sensor housing 17" of Mendelson-799. Pet. 26. We are persuaded that adding a convex cover, such as that taught by Ohsaki, would protect the sensor's internal components. Mendelson-799 is not shown to include a cover over its emitters 12a–c or detectors 16, 18. *See, e.g.*, Ex. 1012, Fig. 7. By contrast, Ohsaki discloses that translucent board 8 with its convex surface covers its emitter and detector. As such, we credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to add a transparent convex cover to Mendelson-799 to "provide additional protection to the elements accommodated within sensor housing 17." Ex. 1003 ¶ 150; *see also* Ex. 1008 ¶ 15 (noting that a cover "protect[s] the LED or PD").

We disagree with Patent Owner's fifth argument that a person of ordinary skill in the art would not have modified Mendelson-799 as proposed because a convex cover would be prone to scratches and because other alternatives existed. PO Resp. 45–47. Patent Owner's counsel did not dispute, during the oral hearing, that a convex cover would indeed serve to protect the internal sensor components in Mendelson-799, as Petitioner proposes. Tr. 64:6–65:5 (but noting that a flat cover would also protect, and would be less prone to scratches). That a convex cover may be more prone to scratches than a flat cover is one of numerous tradeoffs that a person of

ordinary skill in the art would consider, in determining whether the benefits of increased adhesion, signal strength, and protection outweigh the potential for a scratched cover. *Medichem*, 437 F.3d at 1165. The record does not support that the possibility of scratches alone would have dissuaded a person of ordinary skill in the art from the proposed modification, to achieve the benefits identified by Petitioner.

For the foregoing reasons, we are persuaded by Petitioner's contentions.

vii. "[h] a handheld computing device in wireless communication with the physiological sensor device, wherein the handheld computing device comprises"

Petitioner's Undisputed Contentions

Petitioner relies upon the teachings of Mendelson-799, Ohsaki, and Schulz, as discussed above, in further combination with Mendelson-2006 for the remainder of the claim limitations. Specifically, Petitioner contends that although Mendelson-799 does not explicitly disclose wireless communication from its sensor to a handheld computing device, its sensor is "for use in an optical measurement device" as part of "a method for non-invasive measurement of a blood parameter." Pet. 37, 43, 57. Patent Owner does not dispute this contention, and we agree with Petitioner. *See, e.g.*, Ex. 1012, code (57) ("A sensor for use in an optical measurement device and a method for non-invasive measurement of a blood parameter.").

Petitioner also contends that Mendelson-2006 discloses a body-worn pulse oximetry system including a sensor module, a receiver module, and a PDA. Pet. 40, 59. Petitioner contends that data processed by the receiver module is transmitted to the PDA and identifies several advantages of

wireless communication noted in Mendelson-2006, including more effective medical care. Pet. 59–60. Patent Owner does not dispute this contention, and we agree with Petitioner. *See, e.g.* Ex. 1010, 1–2 (describing system), 3 ("The stream of data received from the wearable unit is distributed to various locations on the PDA's graphical display."), 4 (explaining that wireless communication results in "more effective medical care"); Fig. 1 (sensor attached to skin), Fig. 3 (PDA).

Petitioner's Disputed Contentions

Petitioner further contends a person of ordinary skill in the art would have found it obvious to enable the sensor of the combination of Mendelson-799, Ohsaki, and Schulz to communicate wirelessly with a handheld computing device such as the PDA of Mendelson-2006, to transfer sensor data and provide more effective care. Pet. 39, 42–43, 57, 60–61; *see, e.g.*, Ex. 1003 ¶¶ 104, 109, 165, 171–175.

Patent Owner's Arguments

Patent Owner presents several arguments directed to Mendelson-2006, including that Mendelson-2006 discloses a single detector (PO Resp. 52), and that Mendelson-2006's sensor is used on the forehead (*id.* at 53). Patent Owner argues that Mendelson-2006 thus confirms that a person of ordinary skill in the art would not have combined Mendelson-799 with Ohsaki or Schulz due to signal strength issues raised by various locations where a sensor might be attached to the user's body. *Id.* at 53–55.

Analysis

We are persuaded that Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony

of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 102–109, 162–176. For example, we credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to implement Mendelson-799 as part of a physiological measurement system including a handheld communication device in wireless communication, in order to enable transfer of information and improve medical care. *Id.* ¶¶ 170–171.

Moreover, we disagree with Patent Owner's arguments. First, we are persuaded by Petitioner's contentions regarding Mendelson-799, Ohsaki, and Schulz, for the reasons discussed above, and we do not discern that the teachings of Mendelson-2006 undercut those contentions in any manner. Second, Petitioner relies on Mendelson-2006 for teachings regarding wireless communications with a handheld device. Pet. 57–69. Patent Owner's arguments do not pertain to the modification actually proposed and, as such, are misplaced.

viii. "[i] one or more processors configured to wirelessly receive one or more signals from the physiological sensor device, the one or more signals responsive to at least a physiological parameter of the user"

The cited evidence supports Petitioner's contention that Mendelson-2006 describes wirelessly transmitting vital physiological information acquired from the sensor to the PDA, which receives it. Pet. 62–63; *see, e.g.*, Ex. 1010, 1, 2 ("The information acquired by the Sensor Module is transmitted wirelessly via an RF link over a short range to a body-worn Receiver Module. The data processed by the Receiver Module can be transmitted wirelessly to a PDA."), 3 (explaining that the PDA "has sufficient computational resources for the intended application" and "can also serve to temporarily store vital medical information received from the

wearable unit"), Fig. 3 (displaying SpO_2 and HR data); Ex. 1003 ¶¶ 179–180.

Petitioner further contends that, in light of these teachings, a person of ordinary skill in the art "would have found it obvious to configure a processor of the PDA to wirelessly receive signals from the physiological sensor device, the signals being responsive to physiological parameters of the user." Pet. 63; *see, e.g.*, Ex. 1003 ¶ 181

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. Ex. 1003 ¶¶ 177–182. Patent Owner does not present any argument against this limitation, apart from the arguments already addressed in Section II.D.5.vii.

ix. "[j]–[l] a touch-screen display configured to provide a user interface, wherein: the user interface is configured to display indicia responsive to measurements of the physiological parameter, and an orientation of the user interface is configurable responsive to a user input"

The cited evidence supports Petitioner's contention that Mendelson-2006 describes a PDA with a touchscreen display configured to display indicia responsive to measurements of, e.g., SpO_2 and HR. Pet. 64–65; *see, e.g.*, Ex. 1010, 3 ("The use of a PDA . . . also provides a low-cost touch screen interface.").

Petitioner acknowledges that "Mendelson-2006 does not explicitly state that an orientation of the GUI provided by the PDA is configurable responsive to a user input." Pet. 66. However, Petitioner contends that a person of ordinary skill in the art would have understood that "the LabVIEW software that was used 'to control all interactions between the PDA and the wearable unit via [t]he graphical user interface' included the option to

configure an orientation of a user interface," e.g. by setting the report orientation to portrait or landscape view. *Id.* (alteration in original); *see, e.g.*, Ex. 1003 ¶¶ 187–188; Ex. 1027, 186 ("Set the report orientation—portrait or landscape.").

Petitioner further contends that, in light of these teachings, a person of ordinary skill in the art "would have found it obvious to make an orientation of the PDA's user interface configurable responsive to a user input, for the sake of user convenience." Pet. 67; *see, e.g.*, Ex. 1003 ¶¶ 189–190.

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny, who testifies that the proposed modification would have allowed for easy activation of various functions. *See, e.g.*, Ex. 1003 ¶¶ 183–191. Patent Owner does not present any argument against this limitation, apart from the arguments already addressed in Section II.D.5.vii.

x. "[m] a storage device configured to at least temporarily store at least the measurements of the physiological parameter"

The cited evidence supports Petitioner's contention that Mendelson-2006 teaches that the PDA is configured to store vital medical information received from the wearable pulse oximeter, and that an ordinarily skilled artisan "would have understood that the vital medical information would have included measurements of the physiological parameters obtained by the physiological sensor device (e.g., SpO_2 and HR)." Pet. 68; Ex. 1010, 3 ("The PDA can also serve to temporarily store vital medical information received from the wearable unit."); Ex. 1003 ¶ 194.

Petitioner further contends that, in light of these teachings, a person of ordinary skill in the art "would have found it obvious to configure a storage

device of the PDA to at least temporarily store measurements of physiological parameters (e.g., SpO_2 and HR)." Pet. 68; *see, e.g.*, Ex. 1003 ¶ 193.

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 192–194. Patent Owner does not present any argument against this limitation, apart from the arguments already addressed in Section II.D.5.vii.

xi. Reasonable Expectation of Success

Patent Owner argues that Petitioner has failed to demonstrate a reasonable expectation of success because Dr. Kenny did not perform a design analysis to create a functional sensor. PO Resp. 55. We disagree. As discussed in detail above, each of Petitioner's proposed modifications to Mendelson-799—whether to include an opaque material with windows, as taught by Schulz; or to include a cover with a convex surface, as taught by Ohsaki; or to communicate with a handheld computing device, as taught by Mendelson-2006—is rooted in explicit teachings of the prior art, and is supported by persuasive declarant testimony.

We credit Dr. Kenny's testimony that, for each proposed modification, the combined prior art teachings would have been applied as known, to achieve predictable results. *See, e.g.*, Ex. 1003 ¶¶ 92 (applying Ohsaki's teachings would have been "nothing more than the use of a known technique to improve similar devices in the same way, and combining prior art elements according to known methods to yield predictable results—improved adhesion of the sensor to the user's skin, and improved signal strength"), 101 (applying Schulz's teachings would have been "nothing

more than the use of a known technique to improve similar devices in the same way, and combining prior art elements according to known methods to yield predictable results," i.e. to "avoid saturation"), 173 ("applying Mendelson[-]2006's teachings . . . would have led to predictable results without altering or hindering the functions performed by that device. In fact, one of ordinary skill would have been motivated to implement the well-known technique of wirelessly transmitting data . . . to a handheld computing device"). For similar reasons discussed above with respect to each proposed modification, we conclude that that a skilled artisan would have had a reasonable expectation of success. *See supra* § II.D.5.iv, vi, vii–x; *see also* Ex. 1003 ¶¶ 81–195.

xii.Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

6. Independent Claim 20

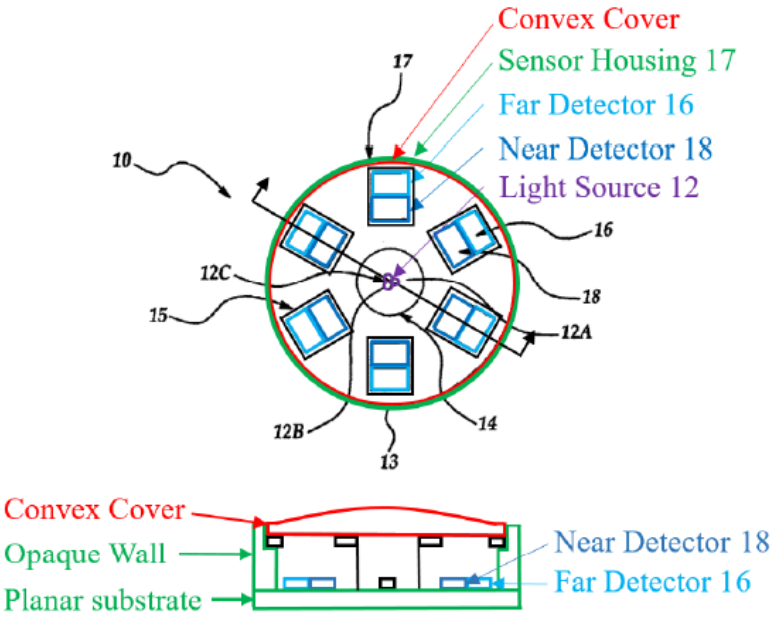
Independent claim 20 consists of limitations that are substantially similar to elements [a]–[h] of claim 1. *Compare* Ex. 1001, 44:51–45:21, *with id.* at 46:31–52 (reciting that the "convex surface," as opposed to "the cover," is "sufficiently rigid"; omitting details of the "handheld computing device"). In asserting that claim 20 also would have been obvious over the combined teachings of Mendelson-799, Ohsaki, Schulz, and Mendelson-2006, Petitioner refers to the same arguments presented as to claim 1. *See* Pet. 79–82. Patent Owner relies on the same arguments discussed above regarding claim 1. PO Resp. 12–63.

For the same reasons discussed above, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 20 would have been obvious over the cited combination of references. *See supra* § II.D.5.

7. Dependent Claims 6 and 25

Dependent claim 6 ultimately depends from independent claim 1 and further recites, "the wall surrounds at least the at least four detectors on the first surface, the wall operably connects to the substrate on one side of the wall, and the wall operably connects to the cover on an opposing side of the wall." Ex. 1001, 45:40–47. Likewise, dependent claim 25 ultimately depends from independent claim 20 and further recites "a substrate having a first surface, wherein the at least four detectors are arranged on the first surface, and wherein the wall surrounds at least the at least four detectors on the first surface, wherein: the wall operably connects to the substrate on one side of the wall, and the wall operably connects to the cover on an opposing side of the wall." *Id.* at 47:15–48:6.

Petitioner contends that the sensor rendered obvious by the combined teachings of Mendelson-799, Ohsaki, Schulz, and Mendelson-2006 "would have included a wall surrounding the photodiodes included in far detector 16 and near detector 18, the wall being operably connected on one side to the planar substrate on which the detectors are arranged, and on an opposing side to a cover," as shown in Petitioner's annotated and modified view of Mendelson-799's Figure 7, as well as an added sectional view, both of which are reproduced below. Pet. 76–77 (citing, e.g., Pet. § IV.B.6.1[d]; Ex. 1003 ¶¶ 132–144, 211–212); *see also id.* at 89–90 (similar discussion regarding claim 25) (citing, e.g., Ex. 1003 ¶¶ 257–29).



Petitioner's annotated and modified figures depict the sensor of Mendelson-799 with an added opaque wall illustrated in green and encircling the sensor components, and operably connected to the convex cover (illustrated in red) on the top and operably connected to the planar substrate of sensor housing 17 (illustrated in green) on the bottom.

Patent Owner argues that "Petitioner provides no independent analysis" for these claims and instead refers back to analyses of claims 1 and 20. PO Resp. 57. Patent Owner also argues that, in the annotated figures, Petitioner includes features not shown in the cited references, e.g., "a cover . . . spanning the entire space above the substrate" and a wall with "notches for the convex cover." *Id.* at 58. Patent Owner argues that "Petitioner cannot satisfy" the claims "by making unexplained changes to the cited art." *Id.* at 59. Moreover, Patent Owner argues that neither Ohsaki nor Mendelson-799 disclose a wall as claimed. *Id.*

As shown in the modified figures above, the wall of the combined sensor surrounds the sensor components and is operably connected to the

convex cover on the top and is operably connected to the planar substrate on the bottom, as claimed. Moreover, as discussed above regarding claim 1, Petitioner's proposed modifications to Mendelson-799 are *not* premised upon bodily incorporating Ohsaki's cover directly with Mendelson-799's sensor. *See In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the teachings of references does not involve an ability to combine their specific structures."). To the contrary, Petitioner proposes incorporating Ohsaki's *teaching* of a cover with a convex surface, not the precise cover and structure disclosed by Ohsaki. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) ("[T]he test is what the combined teachings of those references would have suggested to those of ordinary skill in the art."). If Ohsaki's teaching is implemented in a manner that varies from the precise implementation of such a cover in Ohsaki, e.g., with a larger span or with notches, this is not a material deviation from Ohsaki's express teachings of using a cover with a convex surface to achieve specific benefits, e.g., improved adhesion and signal strength. Ex. 1009 ¶ 25; *see supra* § II.D.5.vi; *see Lear Siegler, Inc. v. Aeroquip Corp*., 733 F.2d 881, 889 (Fed. Cir. 1984) (explaining that a person of ordinary skill is not "compelled to adopt every single aspect of [a reference] without the exercise of independent judgment").

Accordingly, for the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 6 and 25 would have been obvious over the cited combination of references.

8. Dependent Claim 28

Dependent claim 28 ultimately depends from independent claim 20 and further recites "the single protruding convex surface protrudes a height greater than 2 millimeters and less than 3 millimeters." Ex. 1001, 48:16–18.

Petitioner reiterates that the sensor rendered obvious by the combined teachings of Mendelson-799, Ohsaki, Schulz, and Mendelson-2006 would have included a cover with a single protruding convex surface, *see supra* § II.D.5.vi, and further contends that a person of ordinary skill in the art "would have found it obvious that a device designed to fit on a user's wrist would be on the order of millimeters," consistent with Ohsaki's disclosure that the device is in "intimate contact" with the user's skin. Pet. 94–95 (citing, e.g., Ex. 1003 ¶ 269). Petitioner also contends that an ordinarily skilled artisan would have taken user comfort into account when establishing the dimensions of the device's convex cover. *Id.* at 96. With these considerations in mind, Petitioner contends that, "in order to provide a comfortable cover featuring a protruding convex surface that prevents slippage, the surface should protrude a height greater than 2 millimeters and less than 3 millimeters," because "there would have been a finite range of possible protruding heights, and it would have been obvious to select a protruding height that would have been comfortable to the user." *Id.* (citing, e.g., Ex. 1003 ¶¶ 267–271).

Patent Owner argues that none of the cited references disclose the claimed height range and that Petitioner relies on hindsight reconstruction. PO Resp. 60–62 (citing, e.g., Ex. 2004 ¶¶ 104–105). Patent Owner also characterizes Dr. Kenny's testimony as conclusory and unsupported. *Id.* at 62.

Petitioner is correct that, "[w]hen there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product . . . of ordinary skill and common sense." *KSR*, 550 U.S. at 398. Petitioner has shown sufficiently that only a finite number of solutions existed with respect to the height of a convex protrusion on a tissue-facing sensor, which would have met the art-recognized goals of both (1) intimate contact between the sensor's surface and the user and (2) user comfort. *See, e.g.*, Ex. 1009 ¶¶ 6, 25. Bearing in mind these considerations, we credit Dr. Kenny's testimony that it would have been obvious, "in order to provide a comfortable cover featuring a protruding convex surface that prevents slippage, [that] the surface should protrude a height greater than 2 millimeters and less than 3 millimeters." Ex. 1003 ¶ 270.

We have considered Patent Owner's argument, and Dr. Madisetti's cited testimony. However, it is not dispositive that none of Mendelson-799, Ohsaki, Schulz, or Mendelson-2006 teach the claimed range. PO Resp. 60; Ex. 2004 ¶¶ 105–107. Petitioner relies upon the knowledge, ability, and creativity of a person of ordinary skill in the art, not the teachings of a specific reference. Notably, Dr. Madisetti does not dispute Dr. Kenny's position that there were a finite number of options available for the height of the convex surface. Ex. 2004 ¶¶ 104–107. Therefore, we do not agree that Petitioner's contentions are rooted in impermissible hindsight. *See, e.g.*, *In re McLaughlin*, 443 F.2d 1392, 1395 (CCPA 1971) ("Any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning, but so long as it takes into account only knowledge which was

within the level of ordinary skill at the time the claimed invention was made and does not include knowledge gleaned only from applicant's disclosure, such a reconstruction is proper.").

Accordingly, for the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 28 would have been obvious over the cited combination of references.

9. Dependent Claims 2–5, 7, 21–24, 26, and 27

Petitioner also contends that claims 2–5, 7, 21–24, 26, and 27 would have been obvious based on the same combination of prior art addressed above. These challenged claims all depend directly or indirectly from independent claim 1 or 20. Petitioner identifies teachings in the prior art references that teach or suggest the limitations of these claims, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. Pet. 69–79, 82–96. Petitioner also supports its contentions for these claims with the testimony of Dr. Kenny. Ex. 1003 ¶¶ 196–210, 213–215, 237–256, 260–266.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claims 1 and 20. PO Resp. 56 ("The Petition fails to establish that independent claims 1 and 20 are obvious over the cited references of Ground 1 and therefore fails to establish obviousness of any of the challenged dependent claims."); *see supra* § II.D.5.

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–5, 7, 21–24, 26, and 27 would have been obvious over the combined teachings of Mendelson-799, Ohsaki, Schulz, and

Mendelson-2006, for the reasons discussed in the Petition and as supported by the testimony of Dr. Kenny.

10.Conclusion

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 1–7 and 20–28 would have been obvious over the cited combination of references.

III. CONCLUSION

In summary:[10]

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–7, 20–28	103	Mendelson-799, Ohsaki, Schulz, and Mendelson-2006	1–7, 20–28	
Overall Outcome			1–7, 20–28	

[10] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

Upon consideration of the record before us, it is:

ORDERED that claims 1–7 and 20–28 of the ’554 patent have been shown to be unpatentable;

FURTHER ORDERED that, because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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Patent 10,588,554 B2

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CERTIFICATE OF SERVICE

I hereby certify that the original of this Notice of Appeal was filed via U.S.P.S. Priority Mail Express on April 12, 2022 with the Director of the United States Patent and Trademark Office at the address below:

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A copy of this Notice of Appeal is being filed and served on April 12, 2022 as follows:

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